

STEUBEN COUNTY 4-H PARK
STORMWATER, SEDIMENT, AND NUTRIENT REDUCTION PROJECT
DESIGN REPORT

STEUBEN COUNTY, INDIANA

January 11, 2007



Prepared for:
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1.0 Project Description and Purpose

The Steuben County 4-H Park is located on the southeast shore of Crooked Lake near Angola, Indiana (Figure 1). The park grounds are a mixture of buildings and managed turf that provides facilities for the annual Steuben County 4-H Fair and seasonal recreational and educational opportunities for groups such as the local Girl Scout troops and horse and pony participants (Figure 2). Mixed among the buildings and rolling terrain are several large, decadent oak trees that in combination with the proximity of the lake provide a unique county fair setting.

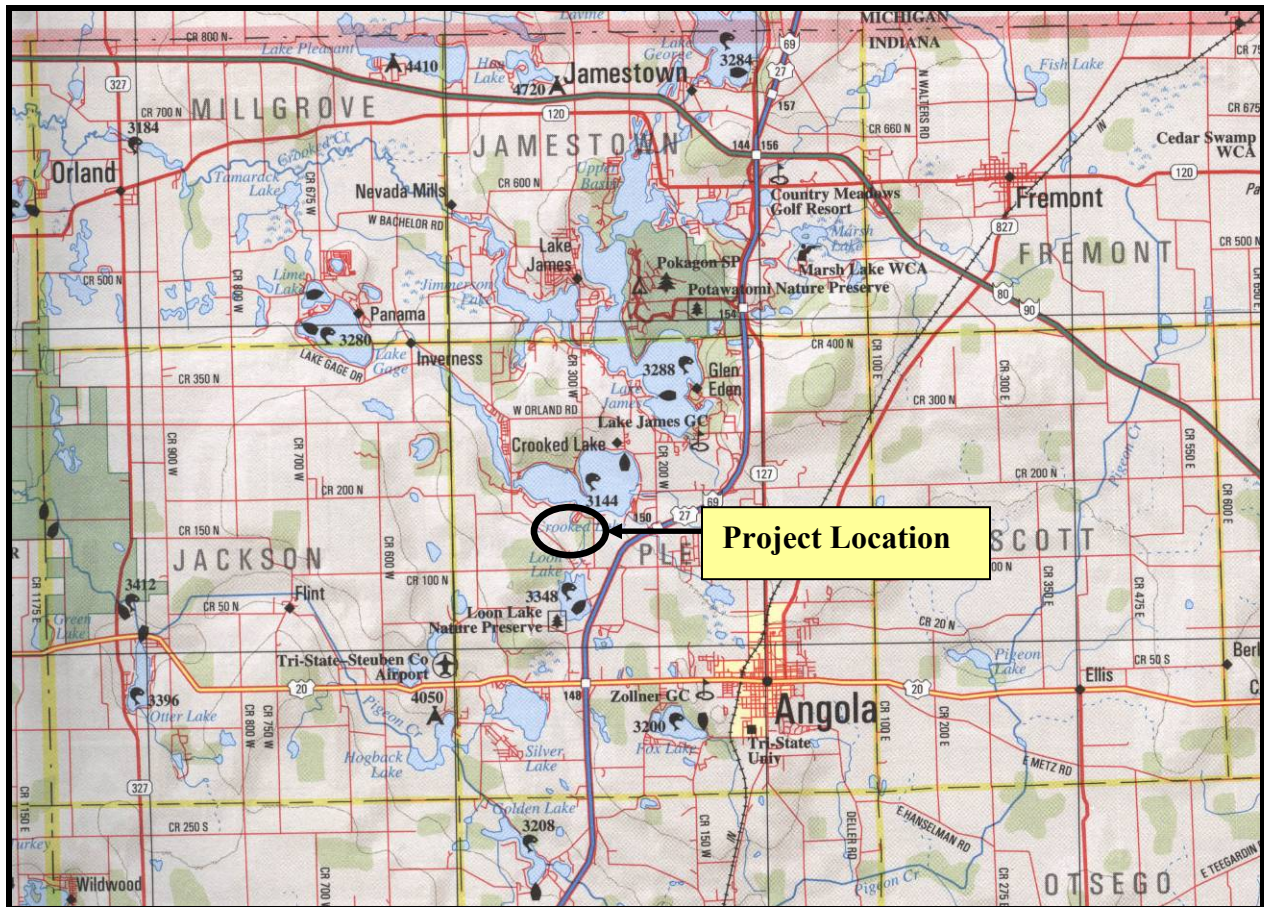


Figure 1. Approximate project location of Steuben County 4-H Park.

The park has been the focus of several efforts to reduce sedimentation into Crooked Lake. Previously, several eroding sections of Carpenter Drain which flows through the park have been stabilized. However, areas within the park are still a significant source of sediments into the lake (Figure 3 and Figure 4). An earlier feasibility study described the need for the installation of

stormwater management practices on the park grounds to reduce direct sediment input into the lake (JFNew 2005). The design was to reduce the sediment load from gravel roads and exposed soils in stormwater entering the lake by slowing the water down and allowing sediment to drop out and by reducing sources of erosion within the park. Portions of the project were constructed using funding from the Great Lakes Commission. Both items already constructed and those that remain to be constructed are described in detail in subsequent sections. Each section indicates that status of the particular item.



Figure 2. Aerial view of Steuben County 4-H Park near Angola, Indiana.



Figure 3. Example of accumulated sediment around and into an existing catch basin. The catch basin then empties directly into Crooked Lake.



Figure 4. Example of erosion occurring along a section of road within the 4-H Park.

2.0 Design Rationale

The design chosen for this site was intended to reduce sediment inputs directly into the lake while maintaining the primary mission of the park grounds which is to provide facilities for the annual 4-H fair. To meet this mission, stormwater management features needed to be integrated into the existing management of the park property. Each type of treatment was designed to minimize the impact to the current uses of the park. French Drains were designed to allow withstand temporary parking and easy foot travel. The plant composition in three of the four raingardens will allow for stormwater filtration, but can also be mowed to allow for parking during the fair. Other features, such as the catch basin, woodland berm and educational raingarden, are not located in high-use areas. Design plans are detailed in Appendix A, while a set of plans detailing the constructed items are included in Appendix B.

The EPA Storm Water Management Model (www.epa.gov) was used to estimate run-off quantity and quality. This model evaluated preliminary draft design features and helped to determine the size and depth of raingardens, French drains and the dry well. Information about watershed size, land cover, topography and percolation rates were entered into the model along with characteristics of each stormwater feature. A copy of model inputs, outputs and a narrative description on the model results can be found in Appendix C. The model was run based on a 10-year event with a maximum hourly peak of 1.6 inches of precipitation/hour, a standard parameter set for stormwater design projects.

3.0 Design and Construction Specifics

3.1 Permitting

No permits were required to perform this work because none of the work occurred within “waters of the U.S.”

3.2 Landowner Agreements

The proposed stormwater control features are located entirely within the Steuben County 4-H Park boundaries. Permission was obtained from the Steuben County Commissioners before beginning the design phase of the project. After review of the several draft designs, the County Commissioners granted their approval to continue with the construction phase of the project. The Steuben County 4-H board was also consulted during the design phase because they are the entity that actively manages the property during the fair. Pertinent information regarding this process and a copy of the meeting minutes where permission was granted for the construction of this project are included in Appendix D.

3.3 Raingardens

Four raingardens were designed to capture and to slow the velocity of stormwater entering Crooked Lake (Figure 5). It was intended that sediment would settle out of the captured stormwater and that water would be retained long enough for it to percolate into the ground. Each raingarden will utilize the use of native plants to filter sediment and uptake nutrients associated with the stormwater.

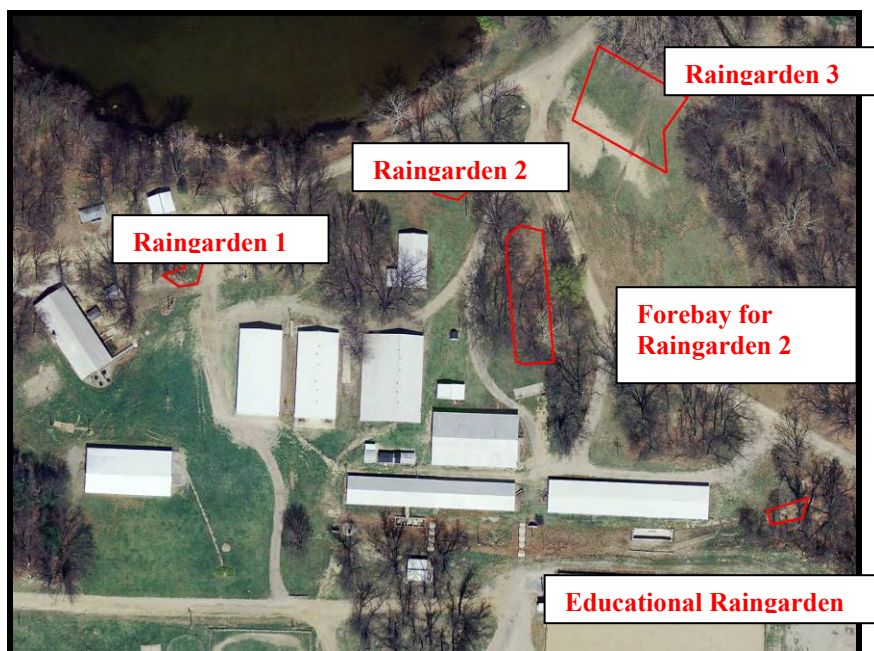


Figure 5. Approximate locations of raingardens within the 4-H Park boundaries.

3.3.1 Raingarden 1

Raingarden 1 is located at the base of the hill, adjacent to two service roads (Figure 5). The western-most French Drain outlets directly into this raingarden. Raingarden 1 is approximately 950 square feet in area with a bottom depth of 2 feet below the top of the surrounding berm. The raingarden was constructed to capture an existing drain that was fitted with a 24-inch vented riser pipe filled and topped with clean stone. The drain acts as the primary outlet for Raingarden 1. An emergency outlet was constructed so that water beyond the capacity of the raingarden flows over the road directly into the lake. The berm was graded to 5:1 slopes on both the inside and outside slopes of the raingarden and tied into the existing elevation at locations along the outside

of berm where the berm meets areas of equal or greater elevation. The raingarden was designed so that the bottom of the raingarden would be over-excavated by approximately 6- to 12-inches and backfilled with 1-inch septic stone. However during the over-excavation activities, clay material dominated the substrate; therefore, an additional 3 feet was excavated and backfilled with a sand and gravel mix to facilitate drainage. The bottom and side slopes of the raingarden were planted with native grass plugs on 2-foot centers. The outside slopes were seeded and mulched with a turf grass mix.

3.3.2 Raingarden 2 and Raingarden 2 Forebay

Raingarden 2 is located at the base of the hill, downhill from the bunny barn (Figure 5). The Raingarden 2 Forebay is located east of the service road adjacent to Raingarden 2 and is connected to Raingarden 2 by an 8-inch drain tile. Both raingardens possess French Drains that empty into them. Raingarden 2 is approximately 1,245 square feet in area with a bottom depth 2 feet below the top of the surrounding berm. A 6-inch drain tile was connected to an existing drain outside the raingarden to provide drainage for water that does not percolate into the ground. An emergency outlet was constructed for water beyond the capacity of the raingarden. This drain overflows into an adjacent drain that empties into the lake. The berm was graded to 5:1 slopes on both the inside and outside slopes of the raingarden and tied into the existing elevation at locations along the berm where the berm meets areas of equal or greater elevation. The bottom of the raingarden was designed to be over-excavated by approximately 6- to 12-inches and backfilled with 1-inch septic stone. However during the over-excavation activities, clay material dominates the substrate; therefore, an additional 3 feet was excavated and backfilled with a sand and gravel mix to facilitate drainage. The bottom and side slopes of the raingarden were planted with native grass plugs on 2-foot centers. The outside slopes were seeded and mulched with a turf grass mix. Raingarden 2 Forebay was constructed in a similar fashion as Raingarden, however, it will be approximately 2,480 square feet in area.

3.3.3 Raingarden 3

Raingarden 3 is designed to be located northeast edge of the project limit (Figure 5). This raingarden has not yet been constructed. When constructed, it will not have any direct connections to any French Drain. Water entering the raingarden will come from overland flow associated with the eastern section of the 4-H park. Raingarden 3 will be approximately 2,500 square feet in area with a bottom depth of 2 feet below the top of the surrounding berm. An outlet spillway will be constructed in the side of the berm and will be located approximately 1-foot below the top of the berm. An emergency outlet will also be constructed for water beyond the capacity of the raingarden and will overflow into an adjacent swale that connects with Carpenter Drain. The berm will be graded to 5:1 slopes on both the inside and outside slopes of the raingarden and tied into the existing elevation at locations along the berm where the berm meets areas of equal or greater elevation. The bottom of the raingarden will be over-excavated by approximately 6- to 12-inches and backfilled with 1-inch septic stone. If during the over-excavation activities clay material dominates the substrate, an additional 3 feet of material will be excavated and backfilled with a sand and gravel mix to facilitate drainage. The bottom and side slopes of the raingarden will be planted with native grass plugs on 2-foot centers. The outside slopes will be seeded and mulched with a turf grass mix.

3.3.4 Educational Raingarden

The Educational Raingarden is located east of the cattle barn on the north side of the service road (Figure 5). It has no direct connection to any French Drain, however, during construction an existing 6-inch subsurface drain was extended so that the drain outlets into this raingarden. The Educational Raingarden is approximately 650 square feet in area with a bottom depth of 2 feet below the top of the surrounding berm. An emergency outlet was constructed for water beyond the capacity of the raingarden. This outlet overflows into an adjacent swale that connects to a culvert that empties into the proposed Woodland Berm area. The berm will be graded to 2:1 slopes on the inside of the raingarden and 3:1 slopes on the outside of the raingarden. When possible, the sloped berm was tied into the existing elevation at locations where the berm meets areas of equal or greater elevation. No clay materials were found during excavation activities; however, old road bed material caused some issues with construction. As much road bed was removed as possible during construction and the excavated area backfilled with a sand and gravel mix to facilitate drainage. The bottom and side slopes of the raingarden were planted with native grasses and forbs on 2-foot centers. Mulch was applied to the inside of the raingarden to prevent weeds and retain moisture for the plants. The outside slopes were seeded and mulched with a turf grass mix. An informational sign was placed outside the raingarden to allow park visitors to understand the concepts behind the use of raingardens. In the spring of 2007, a sign box will be attached to this signpost to provide educational materials regarding the project to park visitors.

3.4 French Drains

Approximately 462 linear feet of French Drains were installed primarily adjacent two main service roads within the park (Figure 5). Each of the three main French Drains outlet directly into raingardens where water will be stored and sediments allowed to settle out. Animal guards were placed at the end of each French Drain to prevent future maintenance problems. French Drains were constructed by excavating a 12-inch wide trench to a depth of 38 inches. Six inches of sand were added to the trench and a 4- to 12-inch perforated drain tile with filter sock were placed on top of the sand in the trench. The size of the drain tile installed depended on the location of the French Drain. See the construction details plan set in Appendix B for exact locations. The remaining trench areas were backfilled with pea gravel to or slightly below the surrounding elevation. The pea gravel was seeded with creeping bent grass. Whenever possible, downspouts and existing surface tiles were tied into the closest French Drain. Where two sections of French Drain intersect, a T-style connector and a vented riser pipe were installed to prevent an airlock from forming.

3.5 Paving

An approximately 200 foot long section of an existing chip and seal service road was re-paved (Figure 5). In addition, a roll-type, mountable curb and gutter were installed on the eastern side of the pavement to contain and direct stormwater runoff. Paving starts directly downhill from the Stage Area barn and continue downhill 200 feet. A 1.5-inch hot asphalt mix was installed on top of the existing chip and seal surface. The mountable curb was installed adjacent to the French Drain with the top of the curb matching the elevation of the French Drain.

3.6 Catch basin and dry-well

A 36-inch diameter catch basin was installed adjacent to an existing culvert along the road north of the Exercise Area (Figure 5). The area was excavated to a depth of 48 inches below the

current grade. The outlet of the catch basin connects to the existing 12" culvert. A 24-inch metal grate was placed on top of the catch basin.

A 10-foot diameter dry-well was constructed in-line with the western-most French Drain (Figure 5). The dry-well was excavated to a depth of 7 feet. The hole was lined with filter fabric and backfilled with 45 tons of washed stone to a depth of 1 foot below the existing grade. A 12-inch vented riser with a screw cap top was installed to a height at or just above the surrounding elevation and connected to both ends of the French Drain. This riser acts as a breather and an observation well. The remaining portion of the hole was backfilled with soil, seeded with turf grass and mulched.

3.7 Woodland Berm

Additional stormwater storage was designed to be created by placing a berm in a low spot between two ridges in the wooded area on the eastern edge of the project (Figure 5). The berm will have a riprap-lined spillway set at approximately one foot below the top of the berm. The berm will be seeded with a custom mix of native species and mulched to prevent erosion. Like raingarden 3, this berm has not yet been constructed.

4.0 Opinion of Probable Cost

The opinion of the probable cost of the stormwater management project is \$50,000. Table 1 shows the cost breakdown per stormwater management feature. Table 2 provides a cost breakdown of materials and labor within each feature.

Table 1. Probable cost estimate for stormwater management features at Steuben County 4-H Park.

Item	Material Cost	Installation Cost	Total
Raingarden 1	\$1,200	\$2,500	\$3,700
Raingarden 2	\$1,600	\$2,500	\$4,100
Raingarden 2 Forebay	\$3,200	\$2,500	\$5,700
Raingarden 3	\$3,200	\$2,500	\$5,700
Educational Raingarden	\$1,400	\$2,500	\$3,900
French Drains	\$5,700	\$7,500	\$13,200
Paving	\$5,000	\$4,000	\$9,000
Catch basin	\$700	\$1,200	\$1,900
Dry-well	\$500	\$2,000	\$2,500
Woodland Berm	\$400	\$1,200	\$1,600
Subtotal			\$51,300
Contingency	--	10%	\$5,130
Total			\$56,430

Table 2. Worksheet estimates for individual work items within each stormwater management feature.

Feature	Item	Unit	Unit Cost	Quantity	Total
Raingarden 1	Stone	Ton	\$10	30	\$300
	Plants	Each	\$3	283	\$850
	Excavation	Each	\$2,500	1	\$2,500
	24-inch riser	Each	\$50	1	\$50
Raingarden 2	Stone	Ton	\$10	50	\$500
	Plants	Each	\$3	361	\$1,083
	Excavation	Each	\$2,500	1	\$2,500
	6" drain tile	Foot	\$2	40	\$80
Raingarden 2 Forebay	Stone	Ton	\$10	50	\$500
	Plants	Each	\$3	866	\$2,600
	Excavation	Each	\$2,500	1	\$2,500
	6" drain tile	Foot	\$2	50	\$100
Raingarden 3	Stone	Ton	\$10	60	\$600
	Plants	Each	\$3	866	\$2,600
	Excavation	Each	\$2,500	1	\$2,500
Educational Raingarden	Sign	Each	\$400	1	\$400
	Plants	Each	\$3	333	\$1,000
	Excavation	Each	\$2,500	1	\$2,500
French Drains	Sand	Ton	\$12	20	\$220
	Pea Gravel	Ton	\$10	278	\$2,780
	12" tile	Foot	\$5	462	\$2,300
	Seed	Pound	\$8	50	\$400
	Excavation	Each	\$7,500	1	\$7,500
Paving	Asphalt	Ton	\$60	30	\$1800
	Curb	Foot	\$16	200	\$3,200
	Installation	Each	\$4,000	1	\$4,000
Catch Basin	Catch basin	Each	\$700	1	\$700
	Excavation	Each	\$1,200	1	\$1,200
Dry-Well	Stone	Ton	\$10	45	\$450
	Riser	Each	\$50	1	\$50
	Excavation	Each	\$2,000	1	\$2,000
Woodland Berm	Riprap	Ton	\$15	23	\$350
	Seed	Acre	\$200	0.25	\$50
	Excavation	Each	\$1,200	1	\$1,200
Total					\$51,300

5.0 Bidding Requirements

Example bid documents are included in Appendix E.

6.0 Specifications

Specifications can be found within the design plan set in Appendix A.

7.0 Construction Schedule

Construction was scheduled to begin in June 2006. However, construction was delayed until after the annual 4-H in July to prevent impacts by park users to the newly constructed areas. With the exception of paving, construction was completed by the end of October 2006. Paving occurred in late November 2006.

8.0 Monitoring and Maintenance Schedule

Annual and seasonal maintenance and monitoring of each stormwater feature is highly recommended. Steuben County employs a full-time park manager that already maintains the park grounds. This person will have the responsibility of performing the routine monitoring and maintenance for the constructed features.

Each raingarden should be monitored on an annual basis to determine that outlet structures are not blocked with debris or sediment. Seasonal maintenance of mowing and weed control should occur on a frequent basis. As the native plants get established, the need for weed control should diminish. However, during the first few years, weed control will be a priority. In Raingardens 1-3 (including the forebay), only one native grass species will be planted so maintenance will as simple as periodically mowing the grass, hand-pulling weeds or treating it with a broadleaf-specific herbicide. The educational raingarden is the only one with a mixture of native forbs and grasses. Until these mature, it may be difficult for people to distinguish between what is a native species and what is a “weed” during maintenance activities. It is strongly encouraged that if the local garden group or Girl Scout troop takes responsibility for maintaining the garden that they become familiar with the species plant. A picture guide can be made available to aid in identification.

After a period of time a raingarden may fill with accumulated sediment. This is an indication that it is functioning properly, however, it is also an indication of the amount of erosion in the drainage area to the raingarden. A raingarden with a significant amount of sediment should be maintained by excavating the sediment, refilling with septic stone and replanting with a native plant species. The timeline and frequency of this maintenance activity will be dependent on land use and stormwater practices within the park grounds and the overall drainage area.

French drains should be monitored by making sure that water is flowing out the drain tiles during rain events. Water ponding up along the French drain or failure to see water in the tile may indicate that the tile is plugged or broken. Proper maintenance should include replacing broken sections of tile, adding more pea gravel in sections where it gets pushed out of the trench and over-seeding the pea gravel with creeping bent grass until it becomes fully established. The large field stones at the outlet of the French drains into each raingarden should be monitored to make sure that they are clear of leaves and other debris and that they are in a position to dissipate the energy of the flowing water as it exits the tile.

The new area of paving should be maintained in accordance with the proper asphalt maintenance procedures. Leaves, debris and sediment should be removed from the paving surface and gutter on a regular basis to prevent accelerated sedimentation to the raingardens.

The new and existing catch basins should be monitored on a regular basis. Leaves and other debris covering the grates should be removed. As sediment builds up in the bottom of each catch basin, it should be cleaned out on a regular basis to maintain the storage capacity and to prevent accumulated sediment from being washed into the lake. The dry well should be monitored through the designated observation well. If sediment accumulates in the observation well, it should be removed.

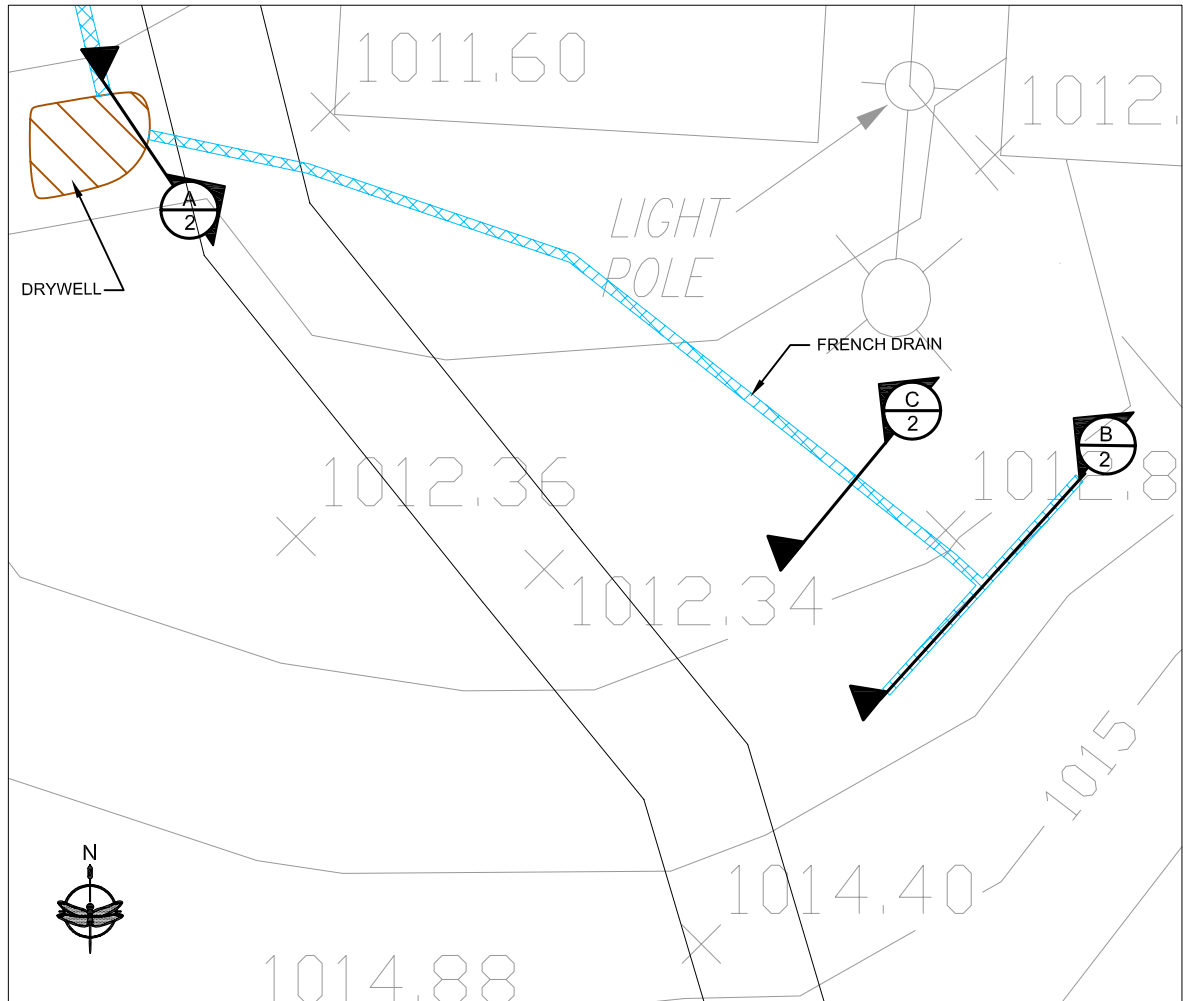
9.0 Project Summary

Significant sedimentation to Crooked Lake is occurring at the Steuben County 4-H park due to erosion during storm events. To reduce this problem, a series of stormwater management features were designed to capture, control and retain stormwater. Using a combination of four raingardens, approximately 750 linear feet of French Drains, a dry well, a catch basin, a berm to retain water and paving both sediments and nutrient inputs into the lake should be reduced. The total cost of the project is approximately \$56,430. Construction of most of these features including Raingardens 1 and 2, the forebay, the educational raingarden, French drain construction and paving occurred in the fall of 2006. Two additional items including Raingarden 3 and the woodland berm have not been completed. Grant money could be obtained to construct these projects in the future if the Steuben County Commissioners and the Crooked Lake Association wish to pursue funding opportunities.

10.0 References

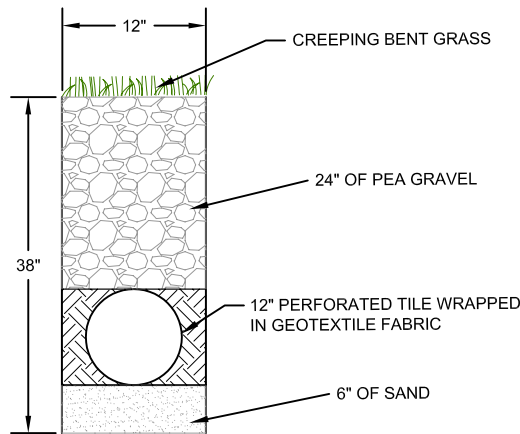
JFNew. 2005. Crooked Lake Engineering Feasibility Study. Walkerton, Indiana.

Appendix A:
Design Plans and Specifications

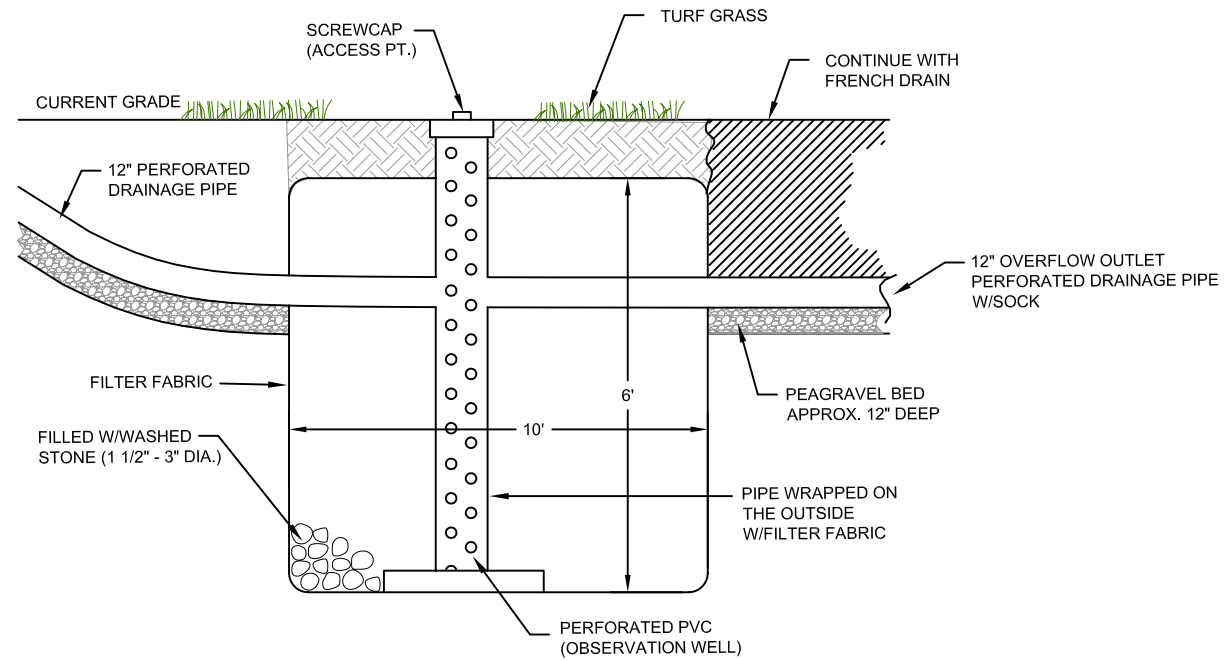


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2 DRY WELL AND FRENCH DRAIN AREA - PLAN VIEW

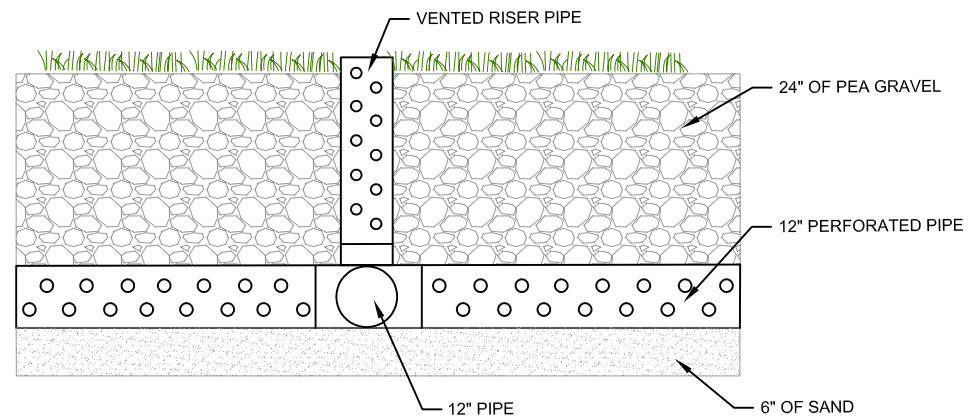
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C
2 8" FRENCH DRAIN - CROSS SECTION
NOT TO SCALE



A
2 TYPICAL DRY WELL - CROSS SECTION
NOT TO SCALE



B
2 12" FRENCH DRAIN - CROSS SECTION
NOT TO SCALE

PRELIMINARY DRAWING;
NOT APPROVED FOR CONSTRUCTION.

SCALE IN FEET
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

JFNew
Corporate/Northern Indiana
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400
Central Indiana
6640 Parkdale Place, Suite S
Indianapolis, Indiana 46254
317-388-1982

REVISION

Drywell and French Drain Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

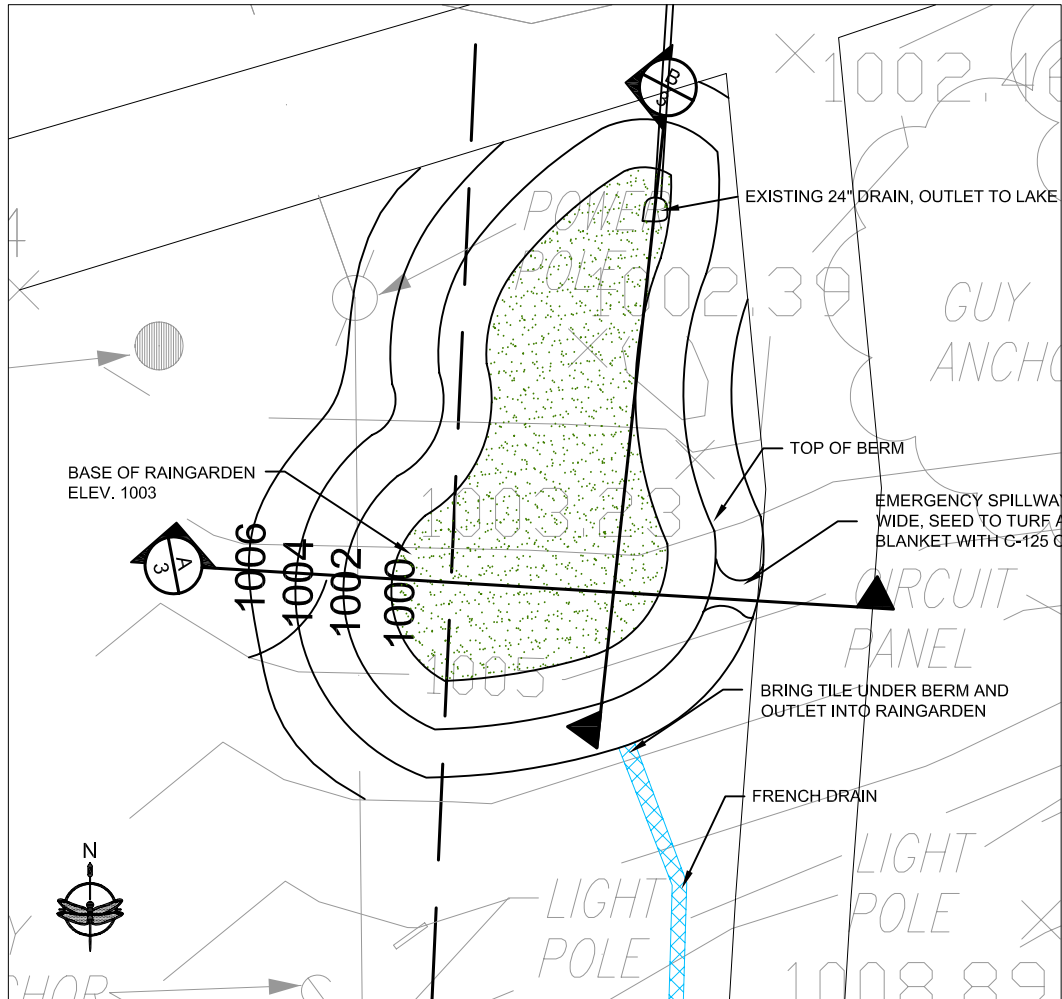
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DESIGNED BY: MP
DATE: APR 2006
JOB NO: 030110

DRAFT

DRAWING NO.

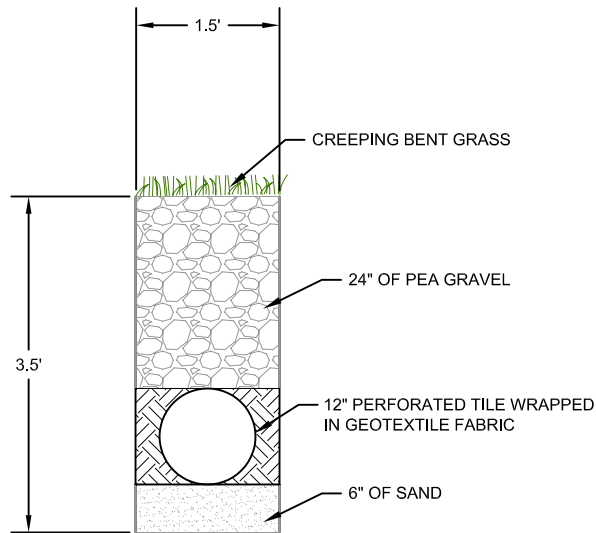
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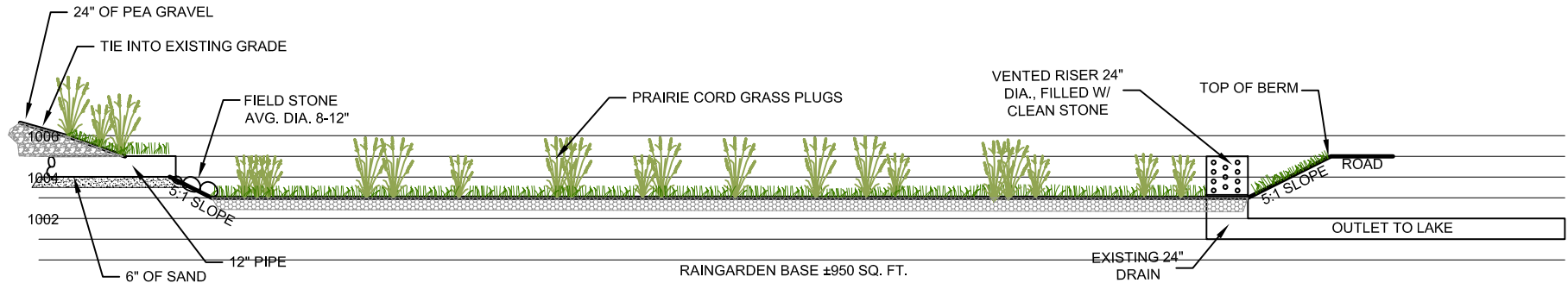


1
3 RAINGARDEN NO. 1 - PLAN VIEW

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2
3 SWALE/FRENCH DRAIN - CROSS SECTION
NOT TO SCALE



B
3 RAINGARDEN NO. 1 - CROSS SECTION
NOT TO SCALE

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Raingarden No. 1 Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

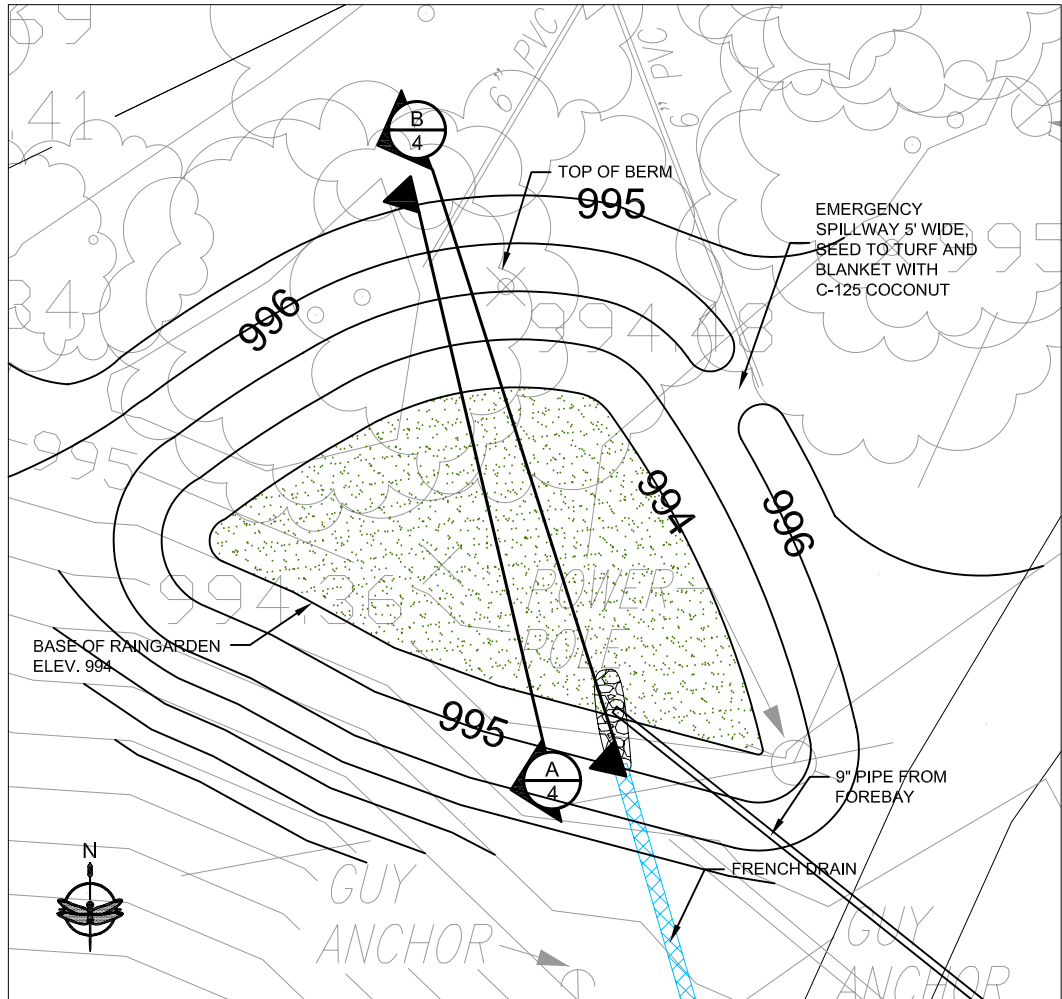
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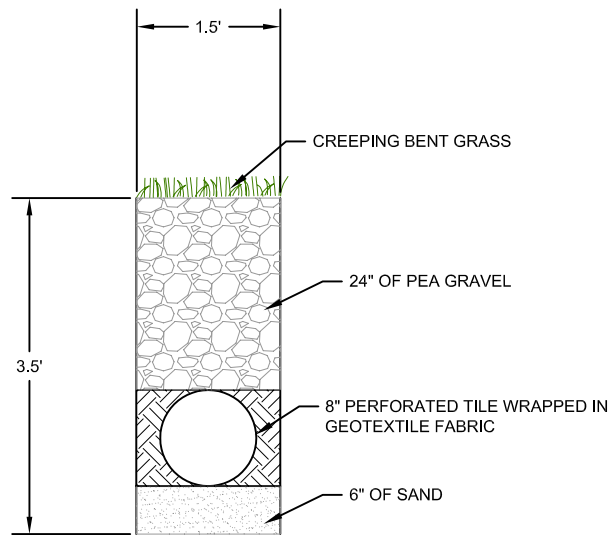
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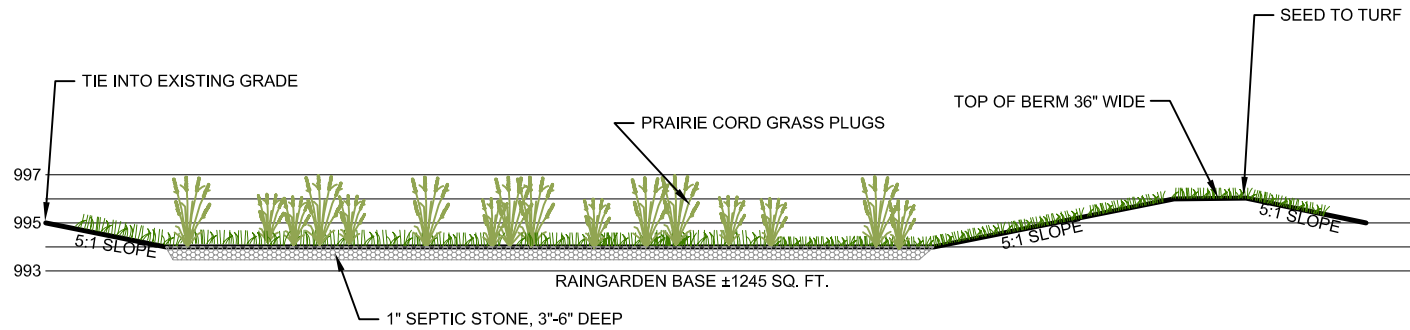


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4 **RAINGARDEN NO. 2 - PLAN VIEW**

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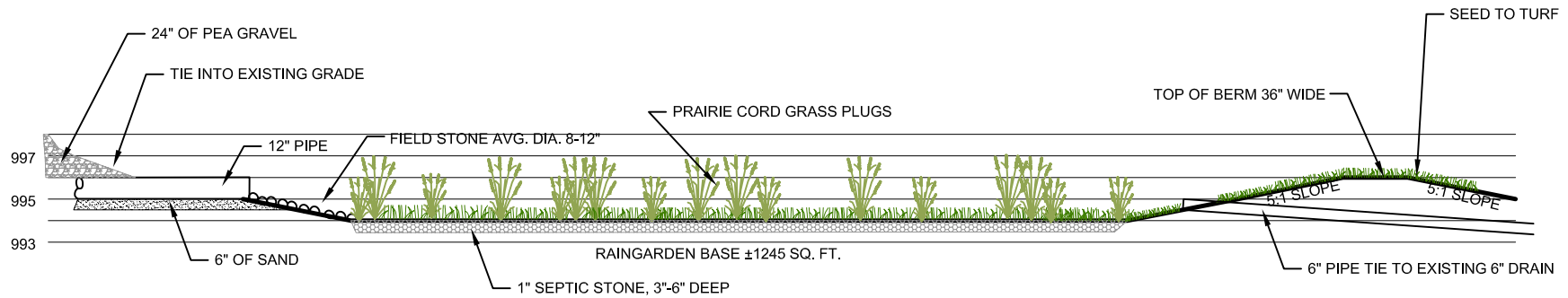
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NOT TO SCALE



A
4 **RAINGARDEN NO. 2 - CROSS SECTION**

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SCALE IN FEET

NOTE:
EXCAVATE AS NECESSARY TO REMOVE CLAY
TO MAX. DEPTH OF 2', REPLACE WITH SAND
AND GRAVEL



B
4 **RAINGARDEN NO. 2 - CROSS SECTION**

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PRELIMINARY DRAWING;
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REVISION

Raingarden No. 2 Details
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Steuben County, Indiana

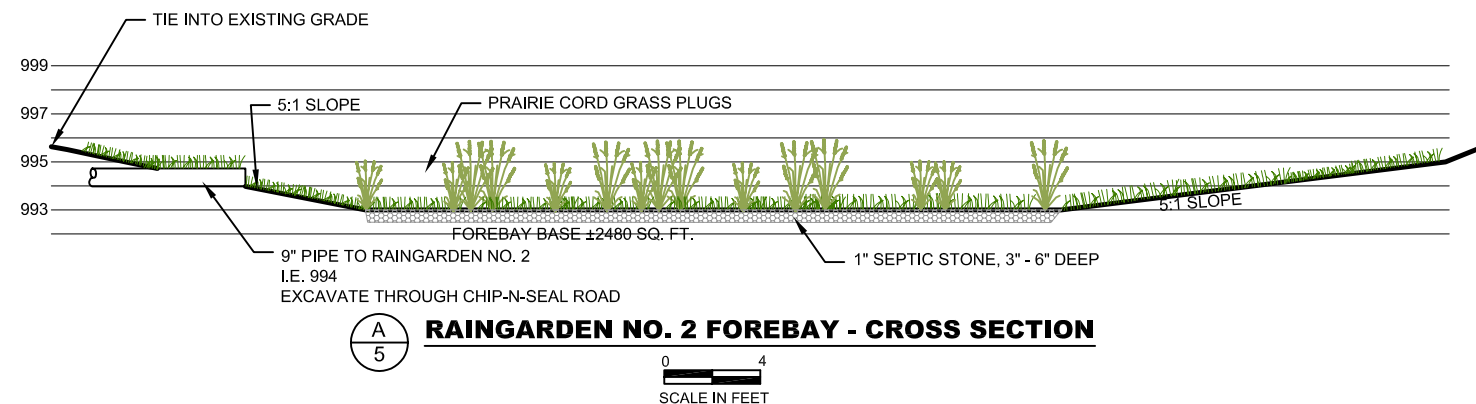
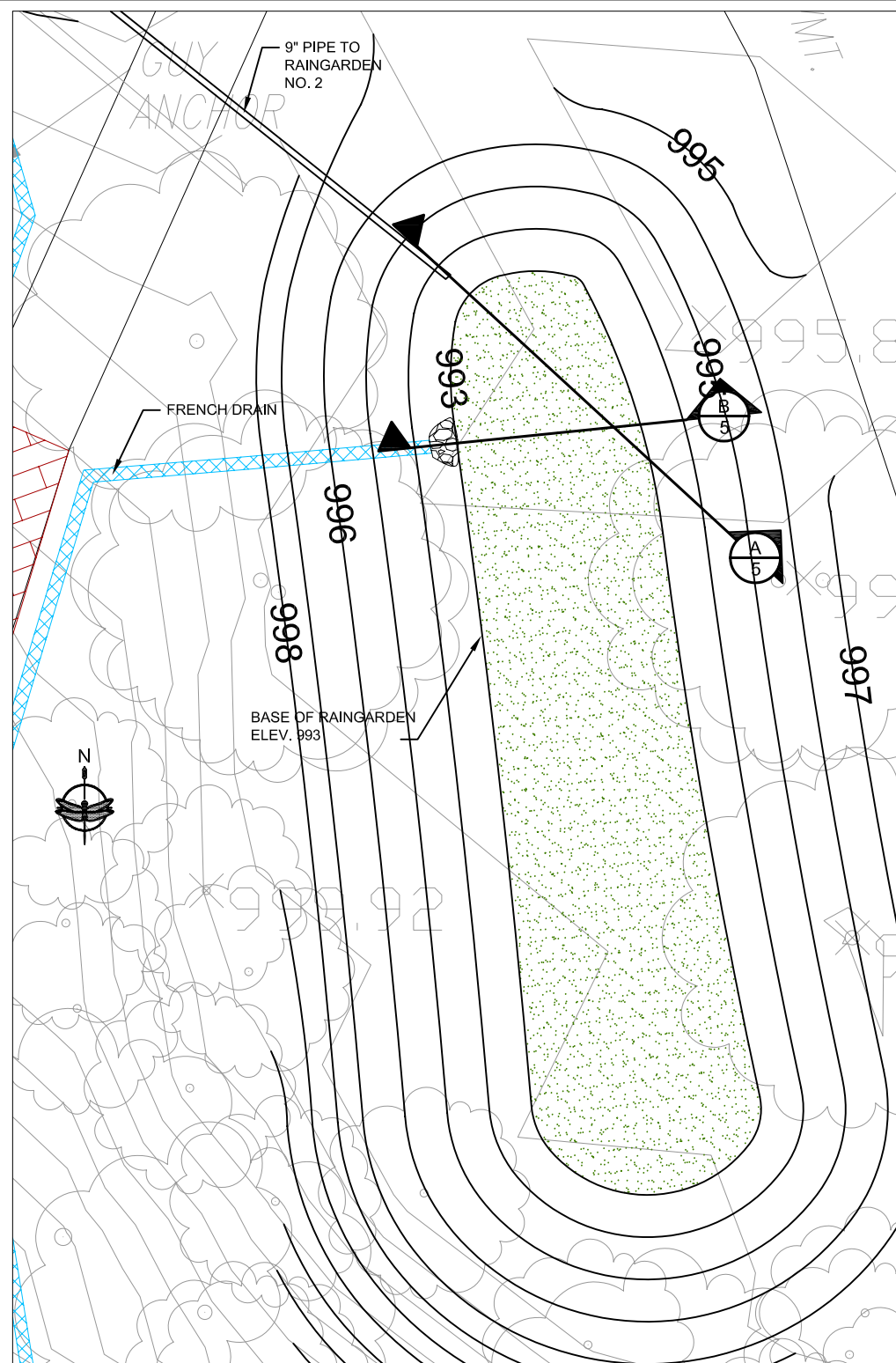
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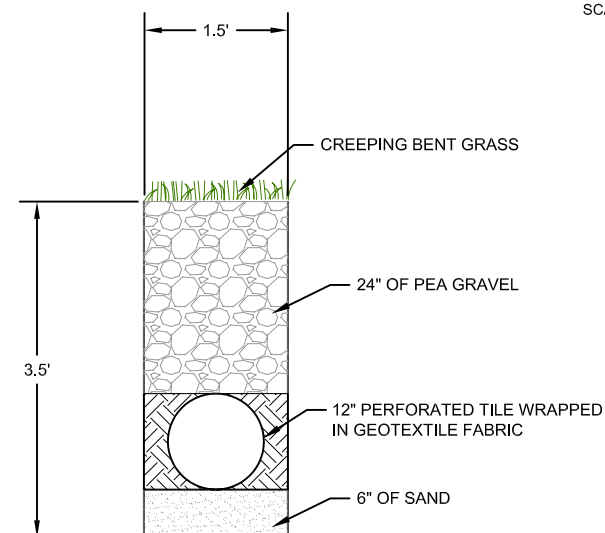
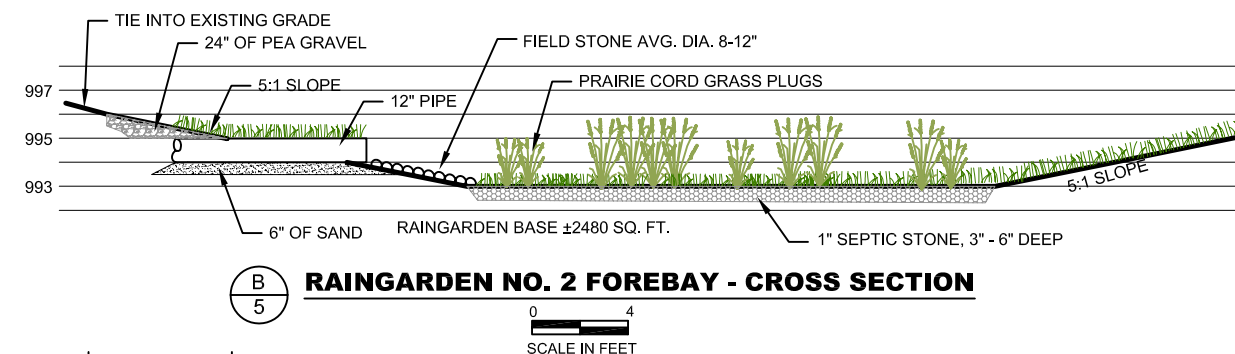
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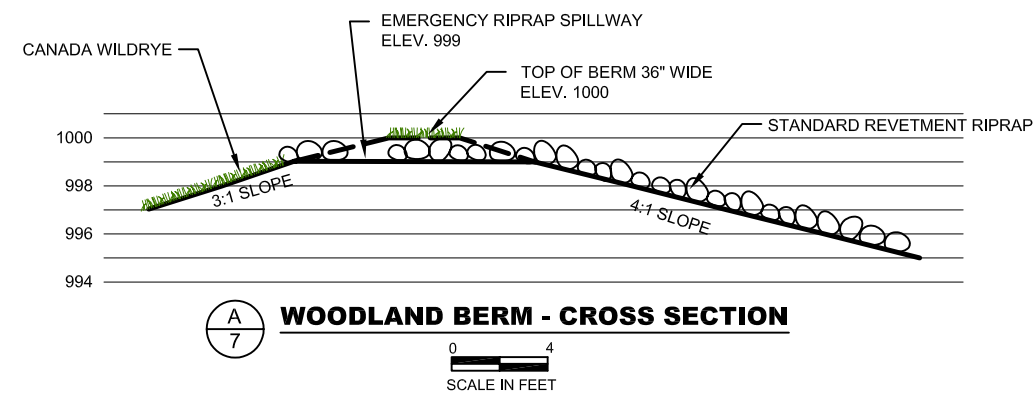
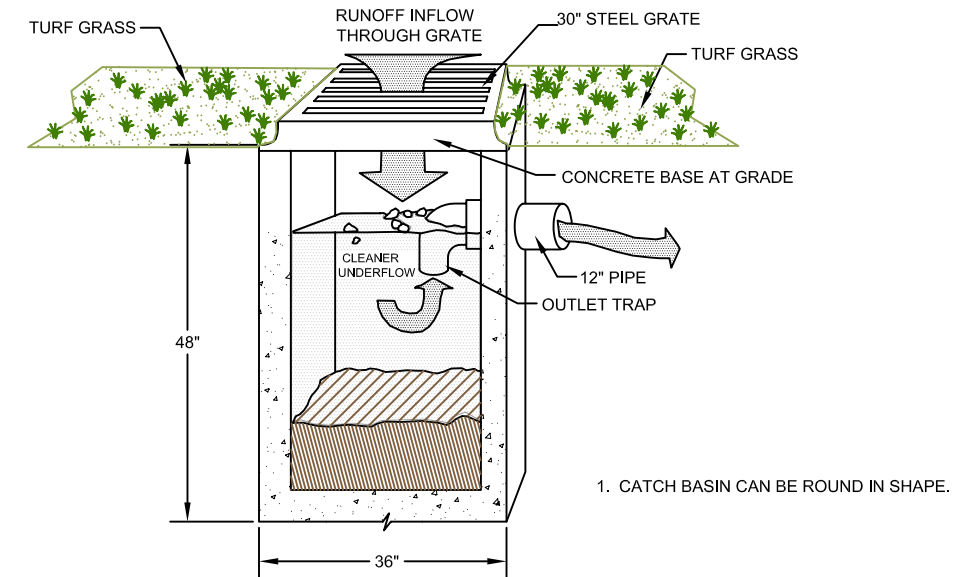
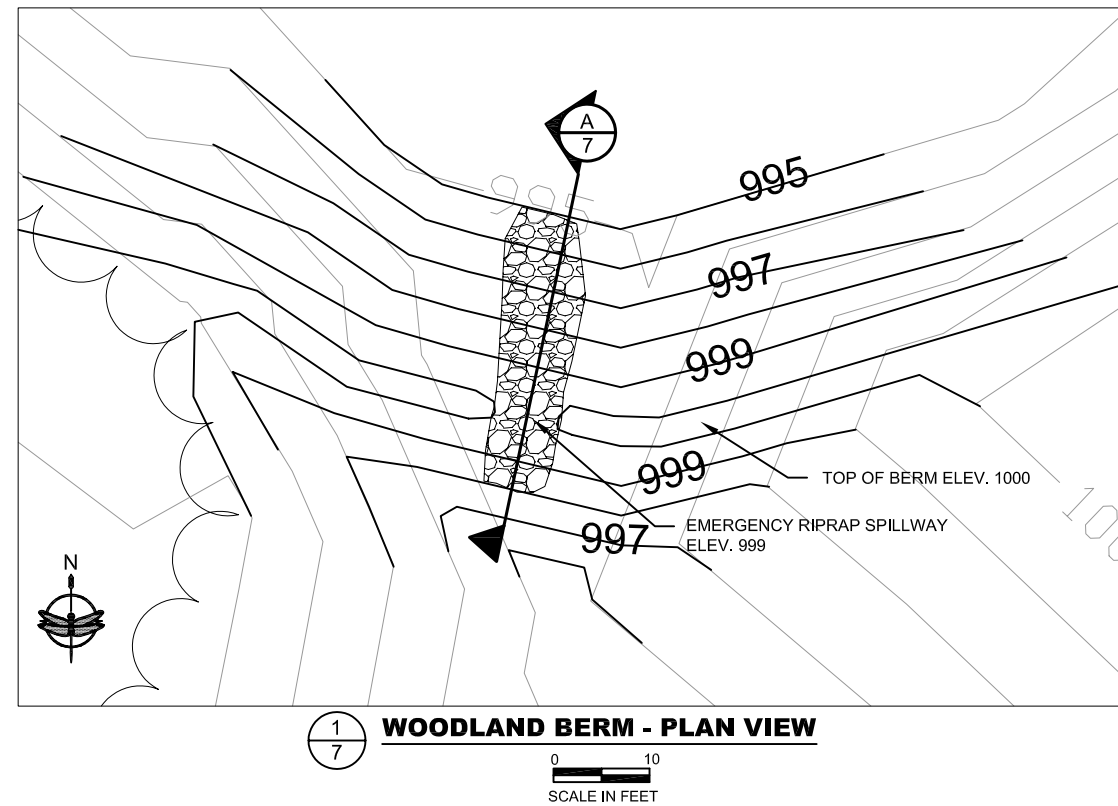
OF 8



NOTE:
EXCAVATE AS NECESSARY TO REMOVE CLAY
TO MAX. DEPTH OF 2', REPLACE WITH SAND
AND GRAVEL



PRELIMINARY DRAWING:
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Raingarden No. 3 and Woodland Berm Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

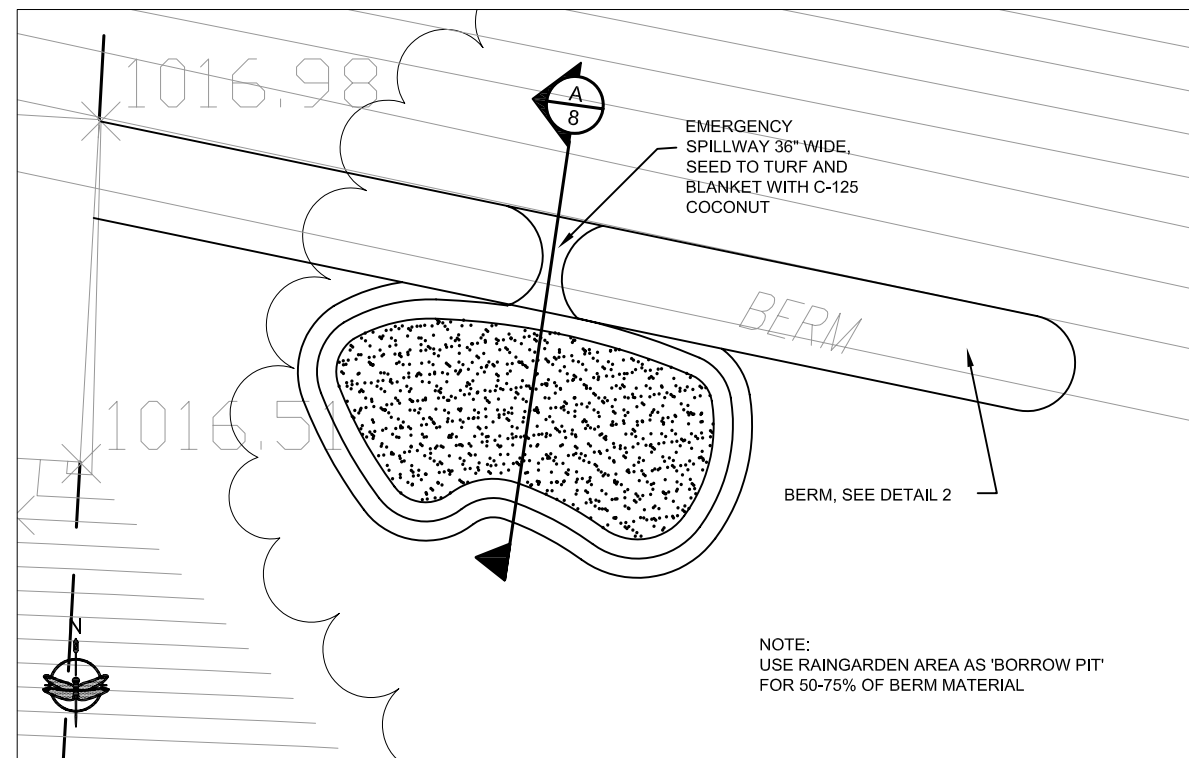
DRAWN BY:	SKL
DESIGNED BY:	MP
DATE:	APR 2006
JOB NO:	030110

DRAFT

DRAWING NO.

7

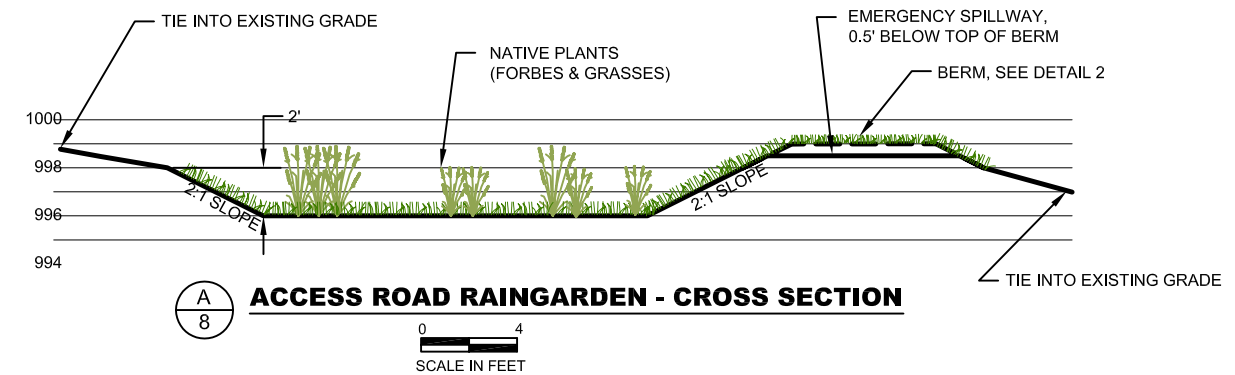
OF 8



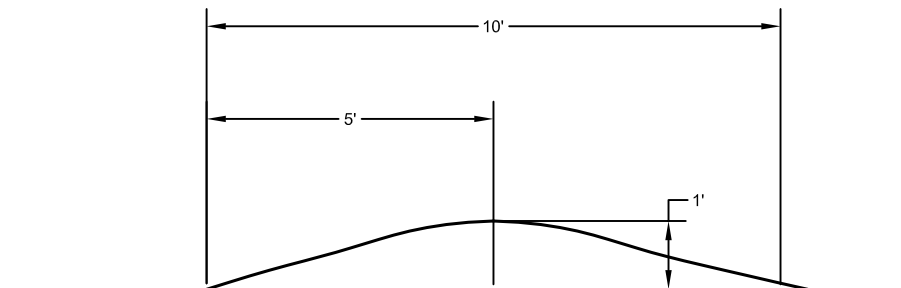
 **ACCESS ROAD RAINGARDEN - PLAN VIEW**

PLANT LIST

Big bluestem	<i>Andropogon gerardii</i>
Brown fox sedge	<i>Carex vulpinoidea</i>
Cardinal flower	<i>Lobelia cardinalis</i>
Foxglove	<i>Penstemon digitalis</i>
Golden alexander	<i>Zizia aurea</i>
Mistflower	<i>Eupatorium coelestinum</i>
New england aster	<i>Aster novae-angliae</i>
Prairie blazing star	<i>Liatris pycnostachya</i>
Purple coneflower	<i>Echinacea purpurea</i>
Side-flowering aster	<i>Aster lateriflorus</i>
Speedwell	<i>Veronicastrum virginicum</i>
Tall bellflower	<i>Campanula americana</i>
White wild indigo	<i>Baptisia leucantha</i>
Wild columbine	<i>Aquilegia canadensis</i>
Yellow coneflower	<i>Ratibida pinnata</i>

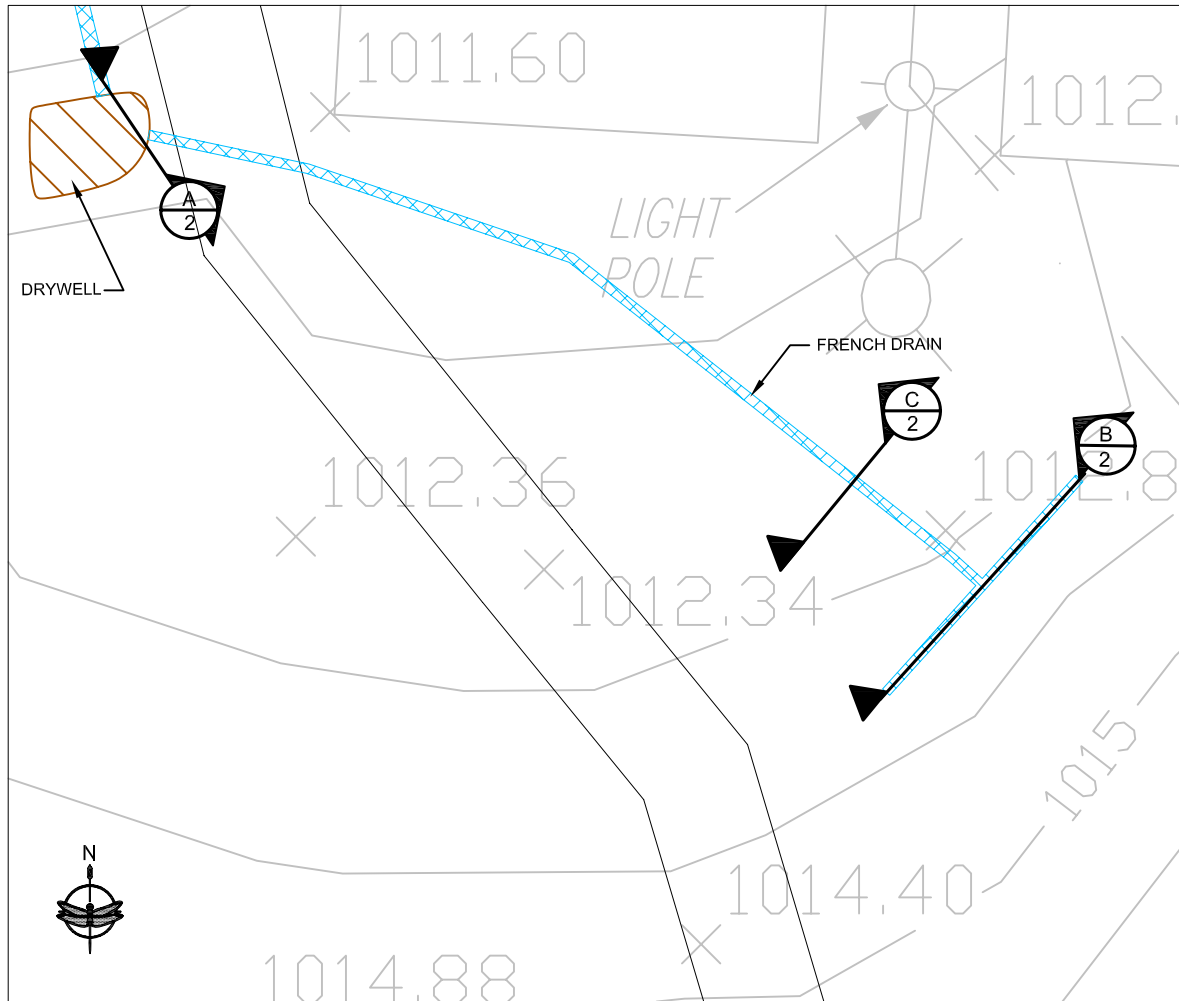


 **BERM - CROSS SECTION**
NOT TO SCALE



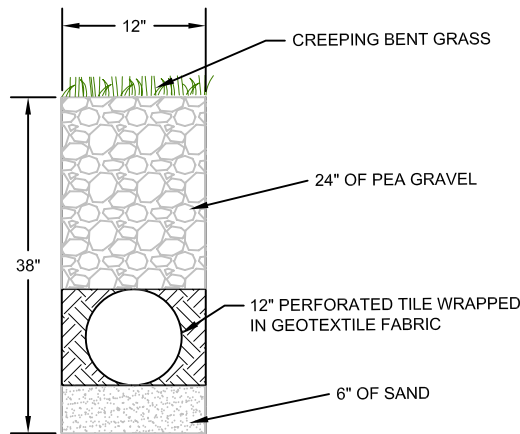
PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

Appendix B:
Construction Plan Set Details

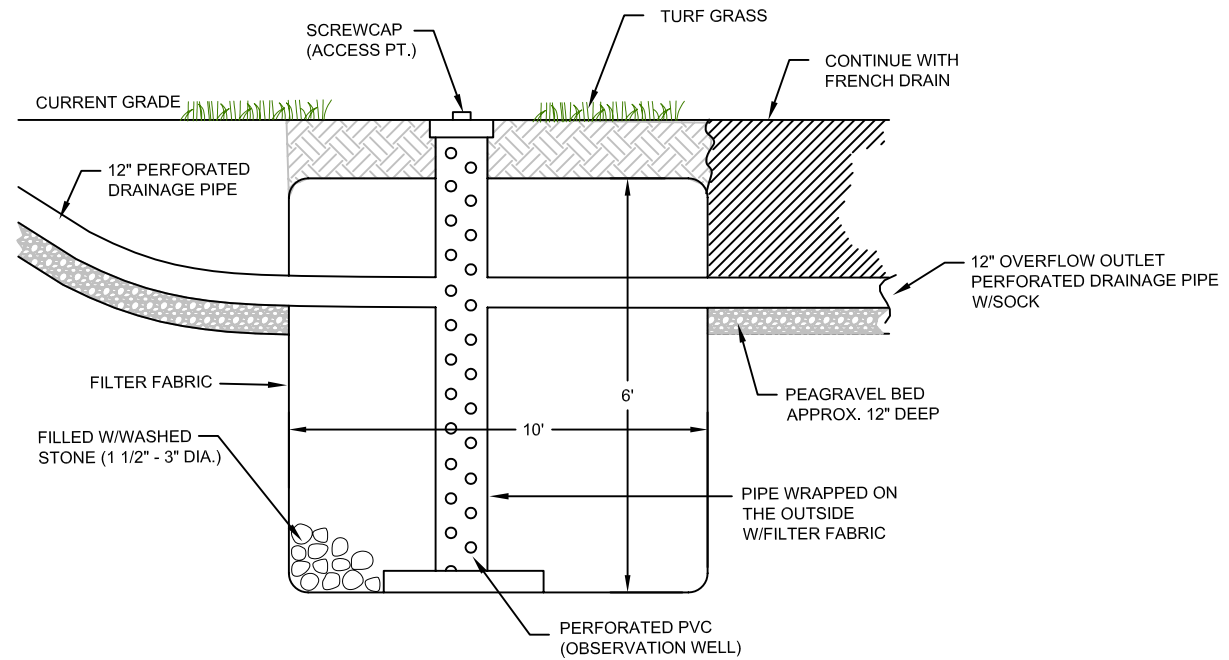


1
2 DRY WELL AND FRENCH DRAIN AREA - PLAN VIEW

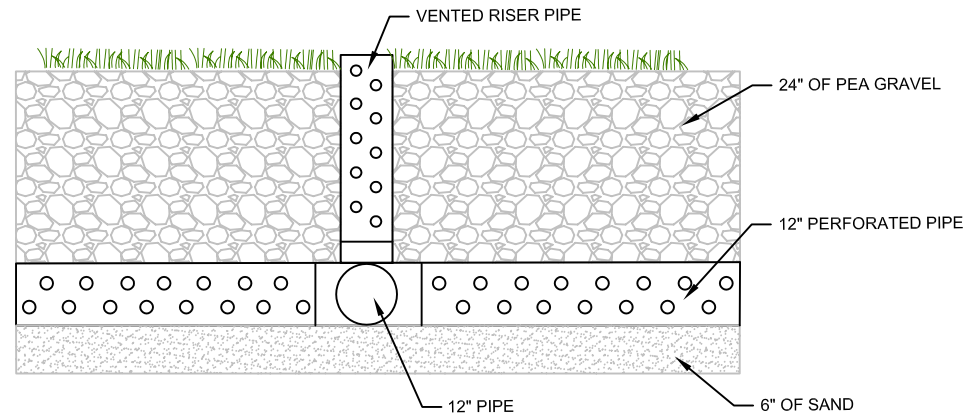
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SCALE IN FEET



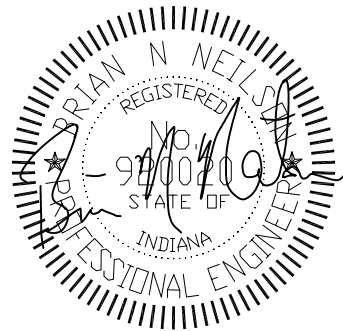
C
2 8" FRENCH DRAIN - CROSS SECTION
NOT TO SCALE



A
2 TYPICAL DRY WELL - CROSS SECTION
NOT TO SCALE



B
2 12" FRENCH DRAIN - CROSS SECTION
NOT TO SCALE



SCALE IN FEET
GRAPHIC SCALE VERIFICATION
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Central Indiana
6640 Parkdale Place, Suite S
Indianapolis, Indiana 46254
317-388-1982

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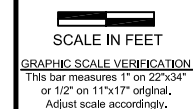
Drywell and French Drain Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

DRAWN BY: SKL/CD
DESIGNED BY: MP
DATE: Nov 2006
JOB NO: 030110

DRAWING NO.

2

OF 8

[illegible]

Raingarden No. 1 Details
Stormwater Design
Steuken County 4-H Park
Crooked Lake Association
Steuken County, Indiana

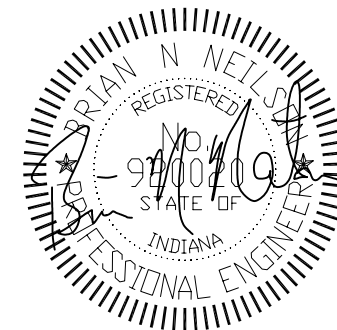
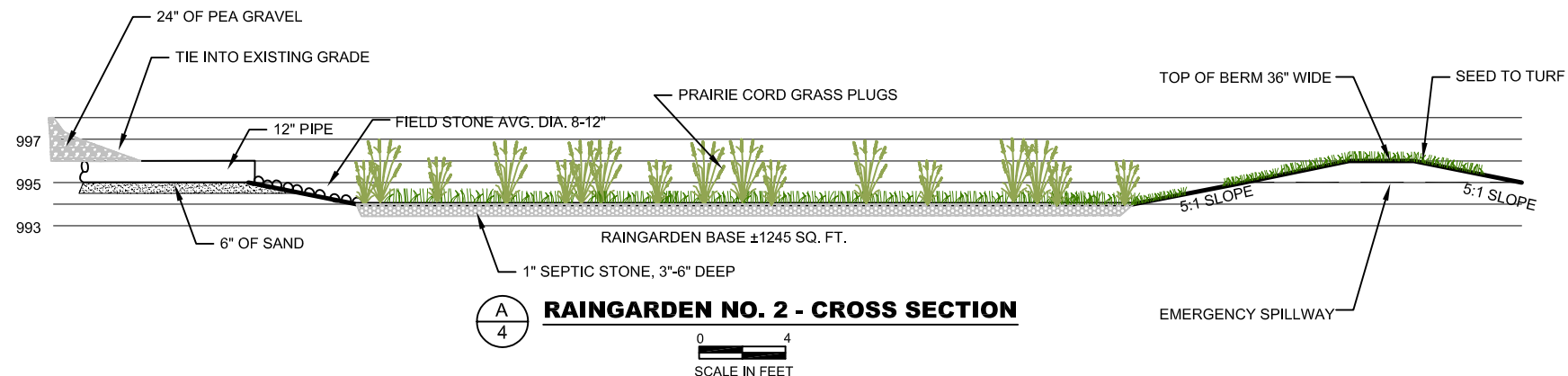
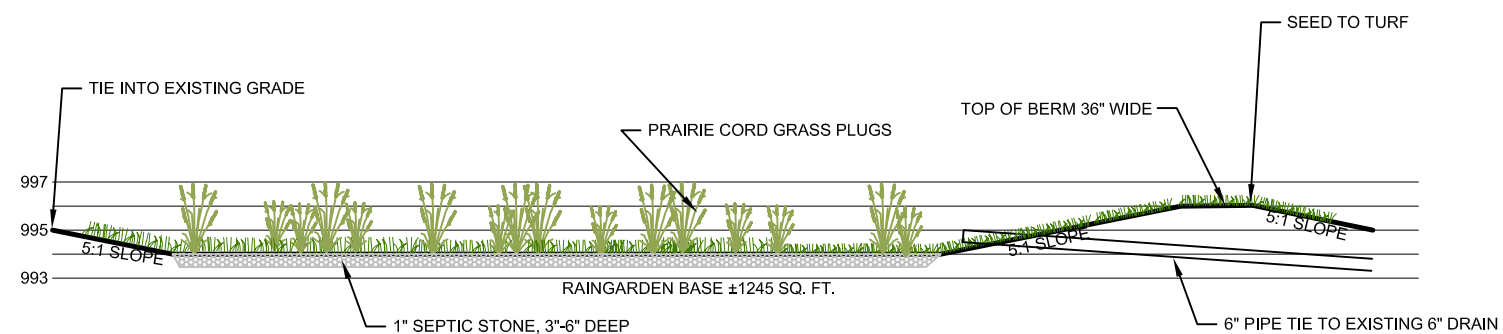
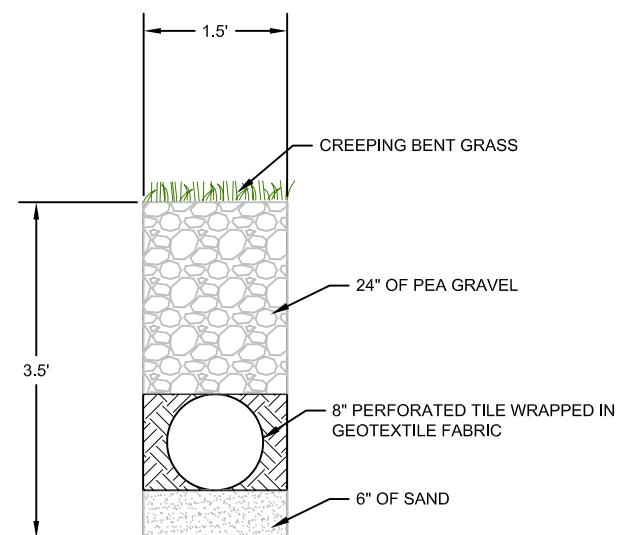
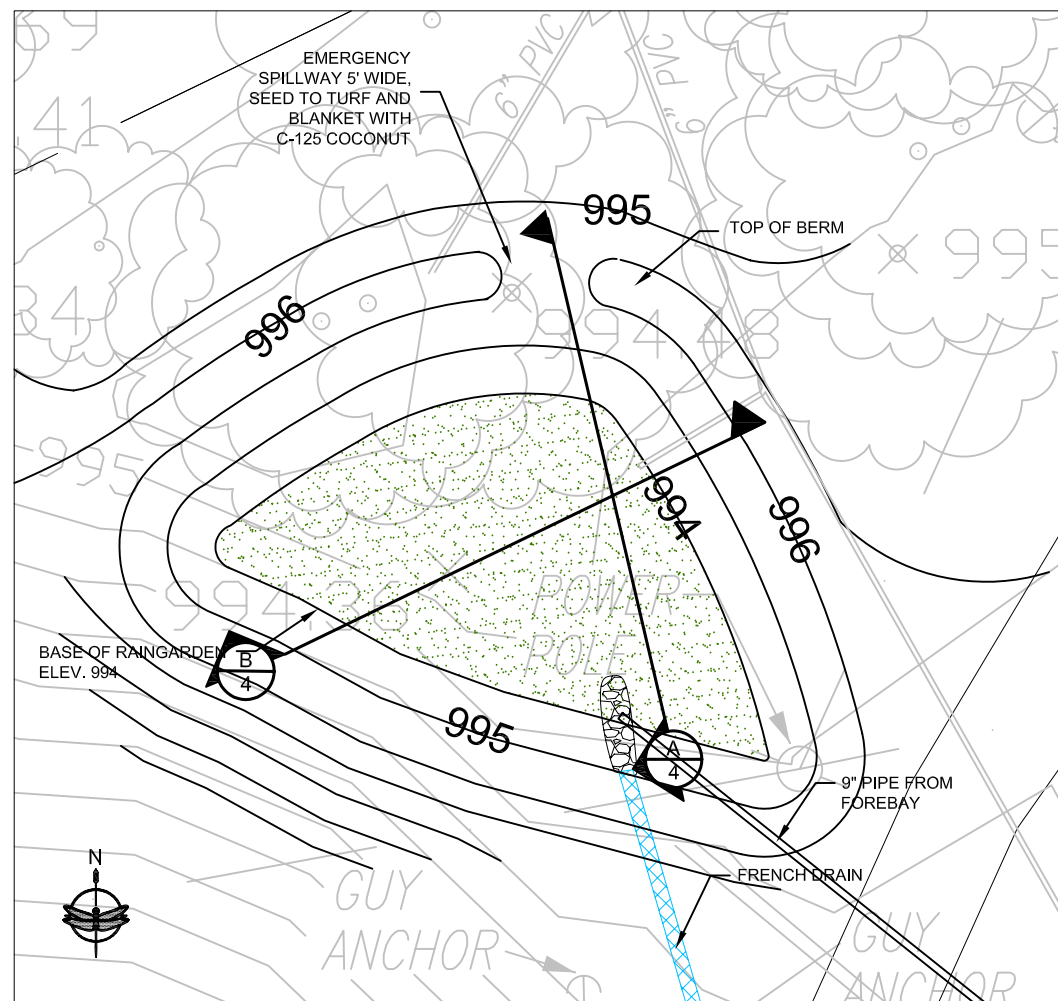
DRAWN BY:	SKL/CD
DESIGNED BY:	MP
DATE:	Nov 2006
JOB NO:	030110

DRAWING NO.

3

OF 8

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 AOUT: RainGarden 1
 DATE/TIME: November 21, 2006 - 1:32pm
 PLOTTED BY: speel



SCALE IN FEET

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[illegible]

Raingarden No. 2 Details
 Stormwater Design
 Steuben County 4-H Park
 Crooked Lake Association
 Steuben County, Indiana

DRAWN BY: SKI /CD

DESIGNED BY: MP

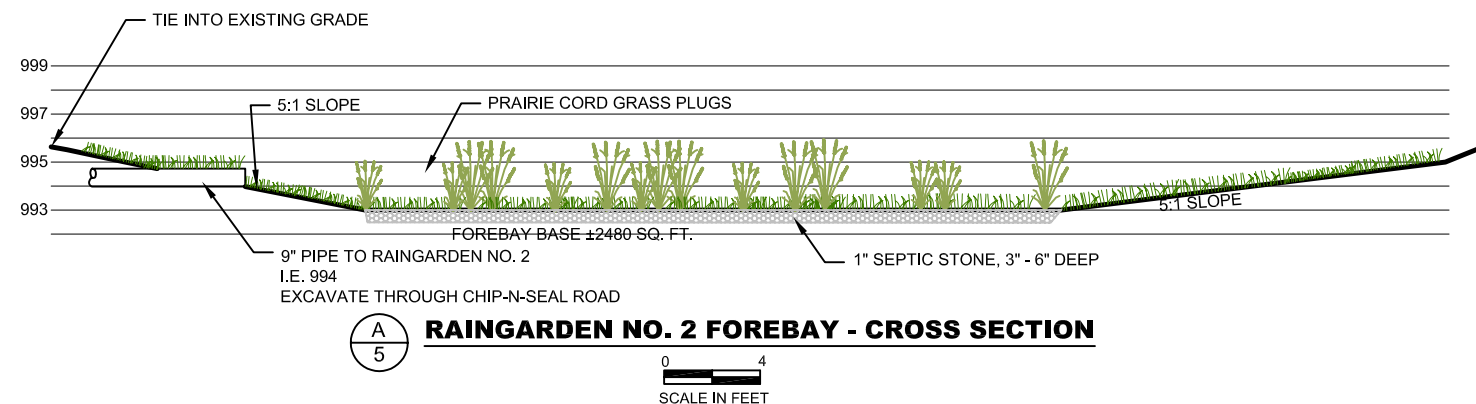
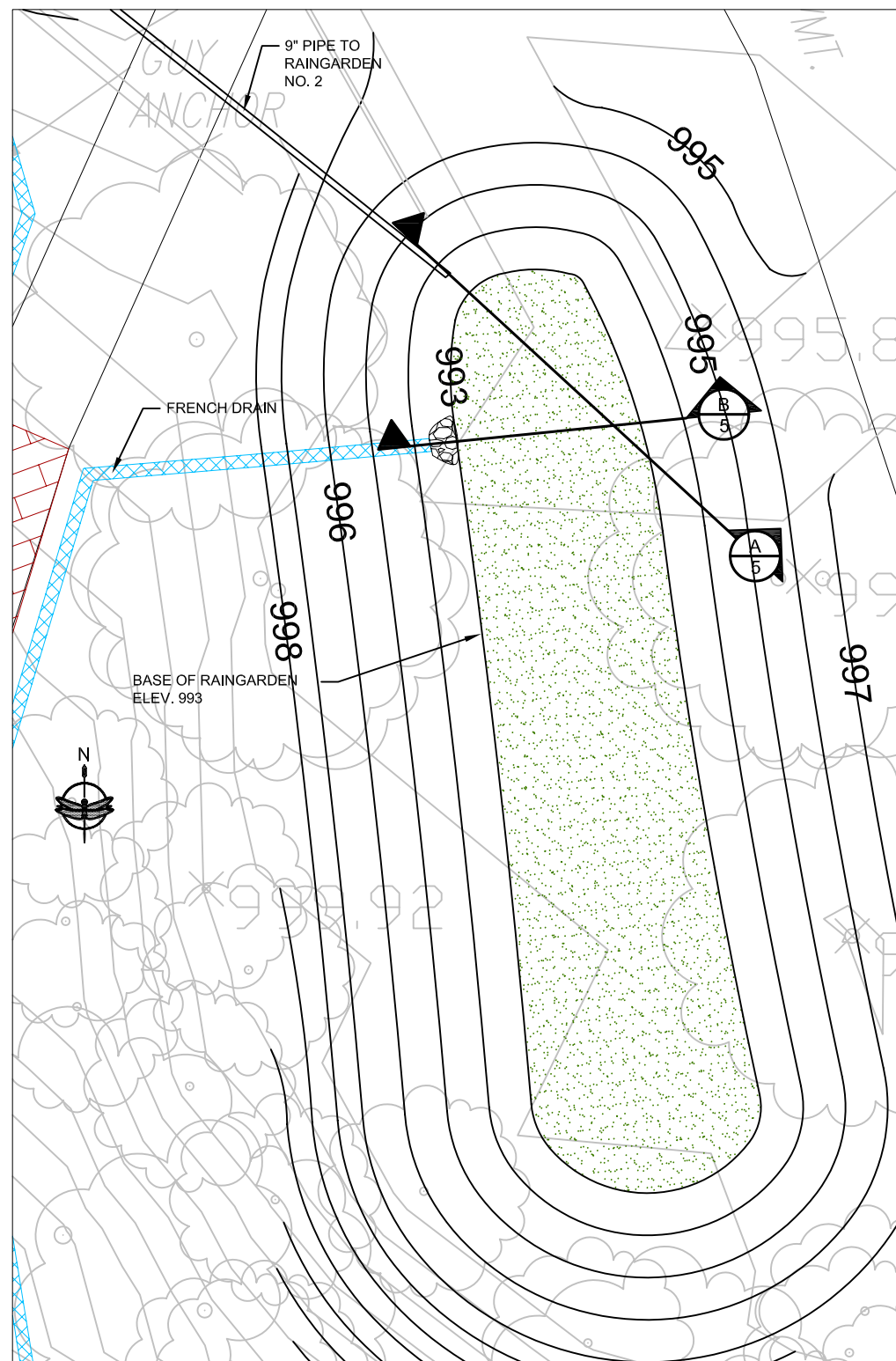
DATE: Nov 2006

JOB NO: 030110

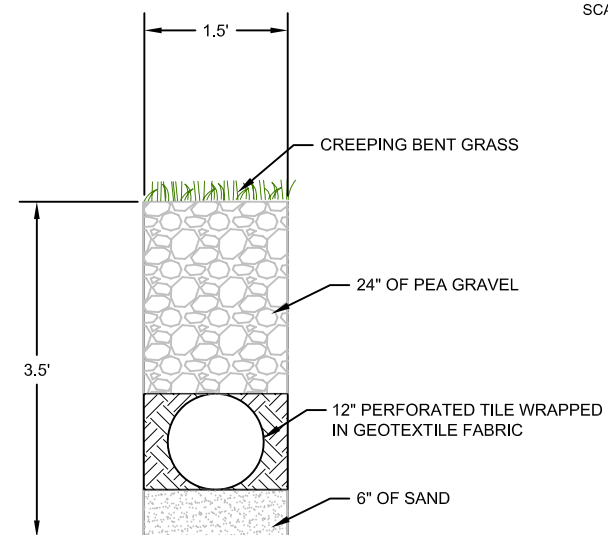
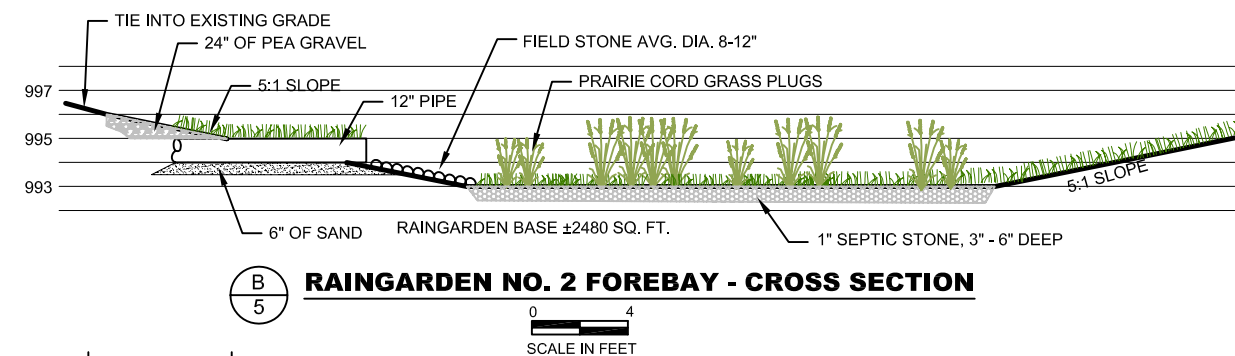
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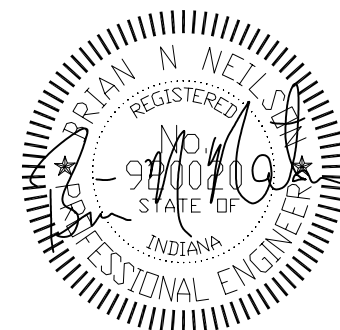
OF 8




NOTE:
EXCAVATE AS NECESSARY TO REMOVE CLAY
TO MAX. DEPTH OF 2', REPLACE WITH SAND
AND GRAVEL



SWALE/FRENCH DRAIN - CROSS SECTION
NOT TO SCALE




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[illegible]

Raingarden No. 2 Forebay Details
Stormwater Design
Steuken County 4-H Park
Crooked Lake Association
Steuken County, Indiana

DRAWN BY: SKI /CD

DESIGNED BY: MP

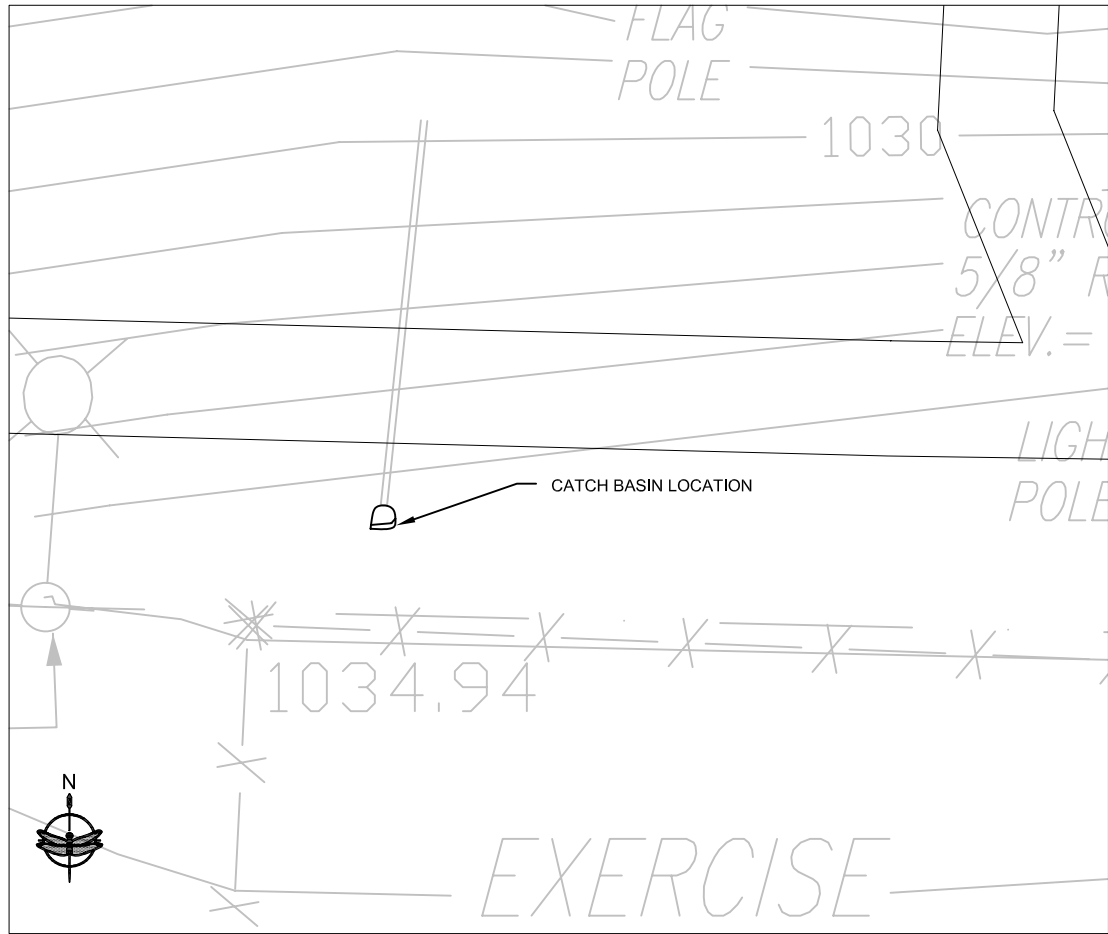
DATE: Nov 2006

JOB NO: 030110

DRAWING NO.

5

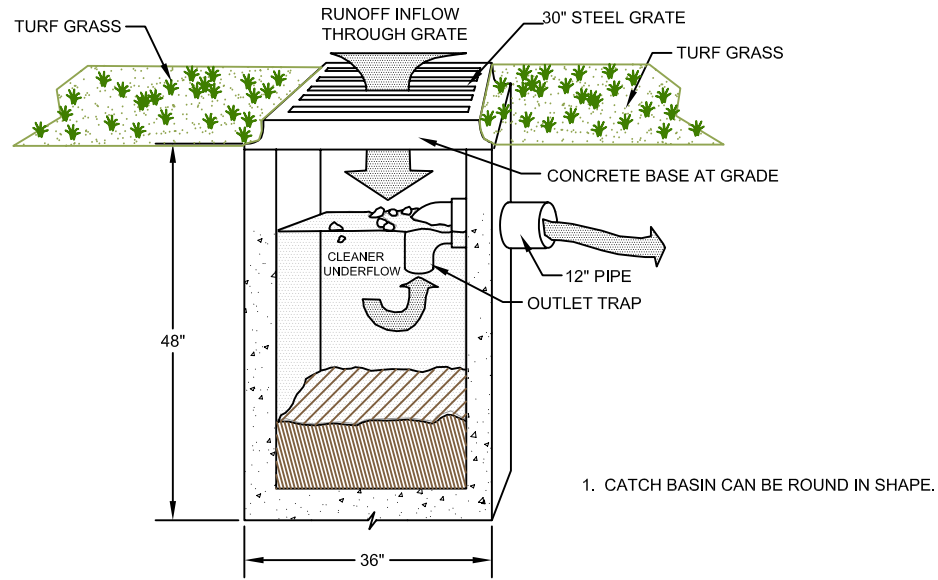
OF 8



1
6

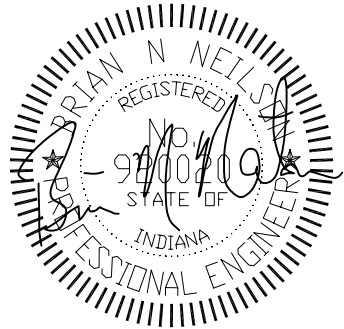
CATCH BASIN LOCATION - PLAN VIEW

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SCALE IN FEET



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6

CATCH BASIN - ISOMETRIC VIEW
NOT TO SCALE



SCALE IN FEET
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Catch Basin Details
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

DRAWN BY: SKL/CD

DESIGNED BY: MP

DATE: Nov 2006

JOB NO: 030110

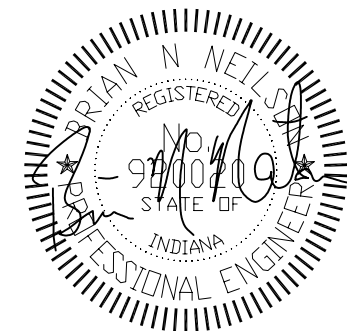
DRAWING NO.

6

OF 8



Big bluestem	<i>Andropogon gerardii</i>
Brown fox sedge	<i>Carex vulpinoidea</i>
Cardinal flower	<i>Lobelia cardinalis</i>
Foxglove	<i>Penstemon digitalis</i>
Golden alexander	<i>Zizia aurea</i>
Mistflower	<i>Eupatorium coelestinum</i>
New england aster	<i>Aster novae-angliae</i>
Prairie blazing star	<i>Liatris pycnostachya</i>
Purple coneflower	<i>Echinacea purpurea</i>
Side-flowering aster	<i>Aster lateriflorus</i>
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Tall bellflower	<i>Campanula americana</i>
White wild indigo	<i>Baptisia leucantha</i>
Wild columbine	<i>Aquilegia canadensis</i>
Yellow coneflower	<i>Ratibida pinnata</i>



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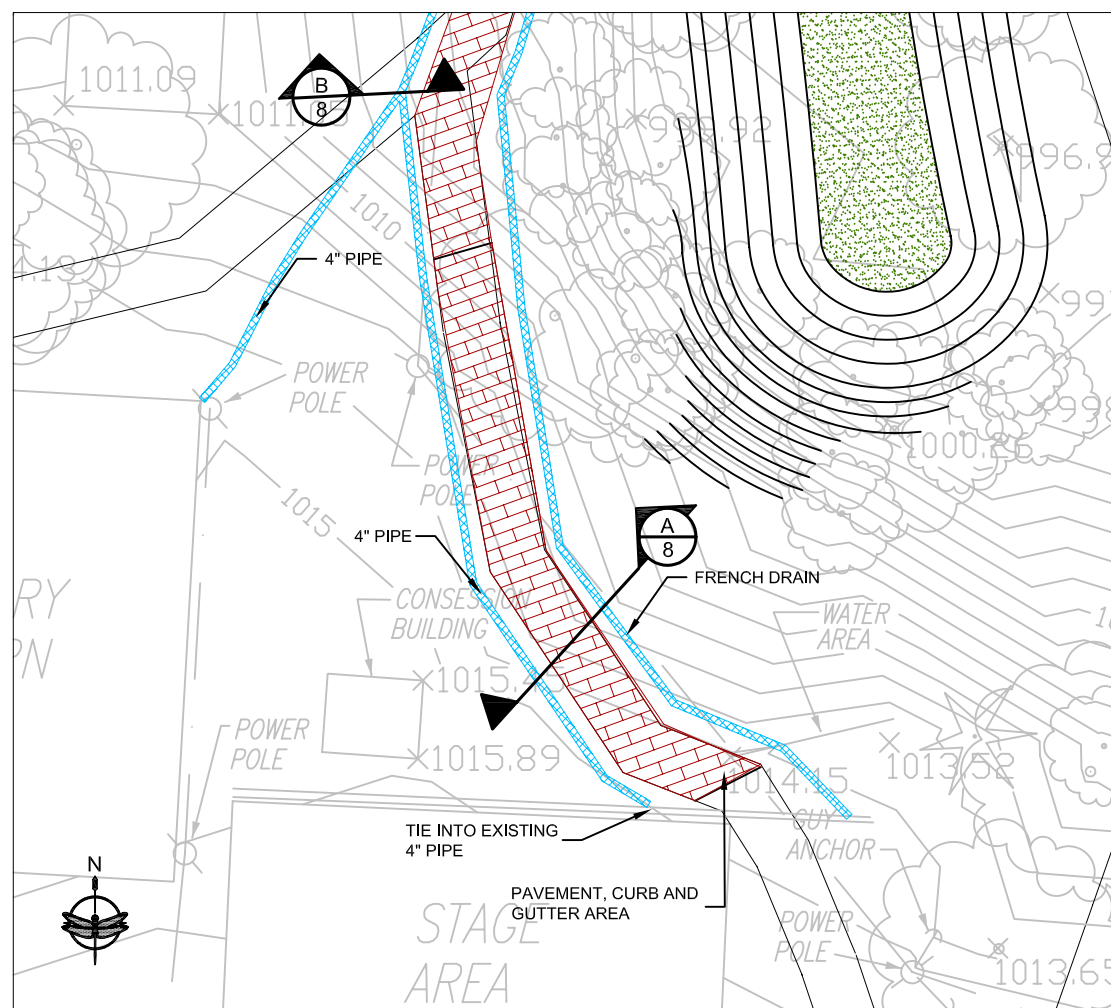
Central Indiana
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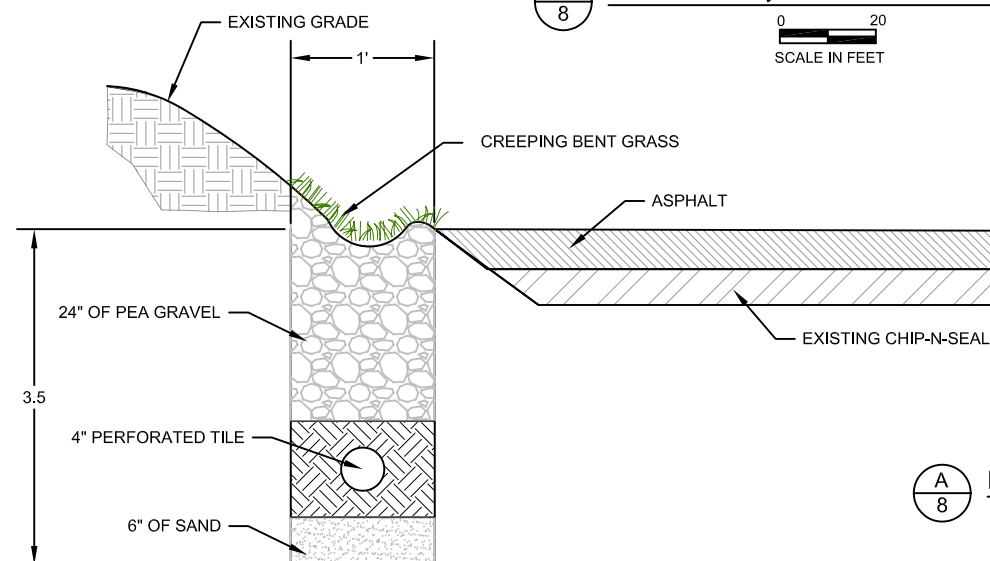
Access Road, Educational
Raingarden and Berm Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

DRAWN BY:	SKL/CD
DESIGNED BY:	MP
DATE:	Nov 2006
JOB NO:	030110

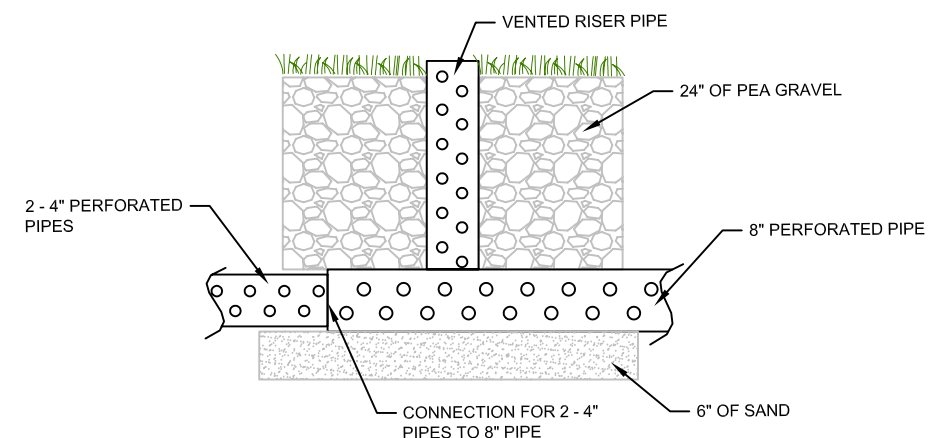
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7
OF 8



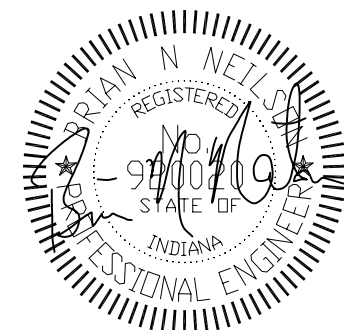
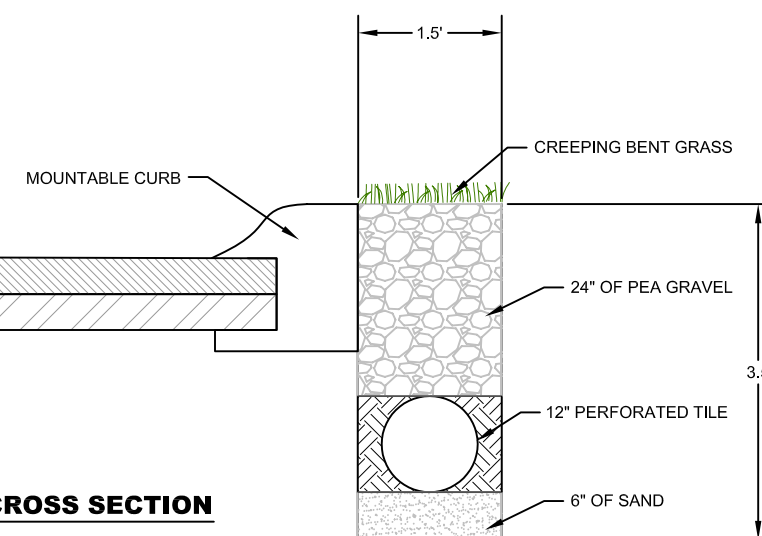
PAVEMENT, CURB AND GUTTER - PLAN VIEW



PAVEMENT, CURB, GUTTER AND FRENCH DRAIN- CROSS SECTION
NOT TO SCALE



4" FRENCH DRAIN - CROSS SECTION
NOT TO SCALE



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[illegible]

Pavement, Curb and Gutter Details
Stormwater Design
Steuben County 4-H Park
Crooked Lake Association
Steuben County, Indiana

DRAWN BY: SKI / C

DESIGNED BY: M

DATE: Nov 20

JOB NO: 0301

DRAWING NO.

8

OF 8

Appendix C:

Engineering Calculations and Computer Model Information

Comments Regarding the Results of the SWMM model (submitted by JFNew Water Resource Engineer, summarized for report purposes)

The parameters used in the model were estimated with the best known information available at the time. Some calculations involved rounding, averaging, etc. so the measurements are not exact. On the other hand, they don't need to be. They need to be in the ballpark. The model results listed below are for the 10-year event (3.5 inches over 24-hours), with a max hourly peak of 1.6 inches/hour. Typical storm sewer design is to this standard.

Comments/Findings:

1. There is quite a bit of slope on site. Swales (French Drains) were sized without stone, just to simplify the analysis. A constant 2ft deep swale, 1ft wide bottom and 3:1 side slopes was used. The next few figures show depths in the swales and velocities (without check dams of any kind):

This is for the 2 swales to the west:

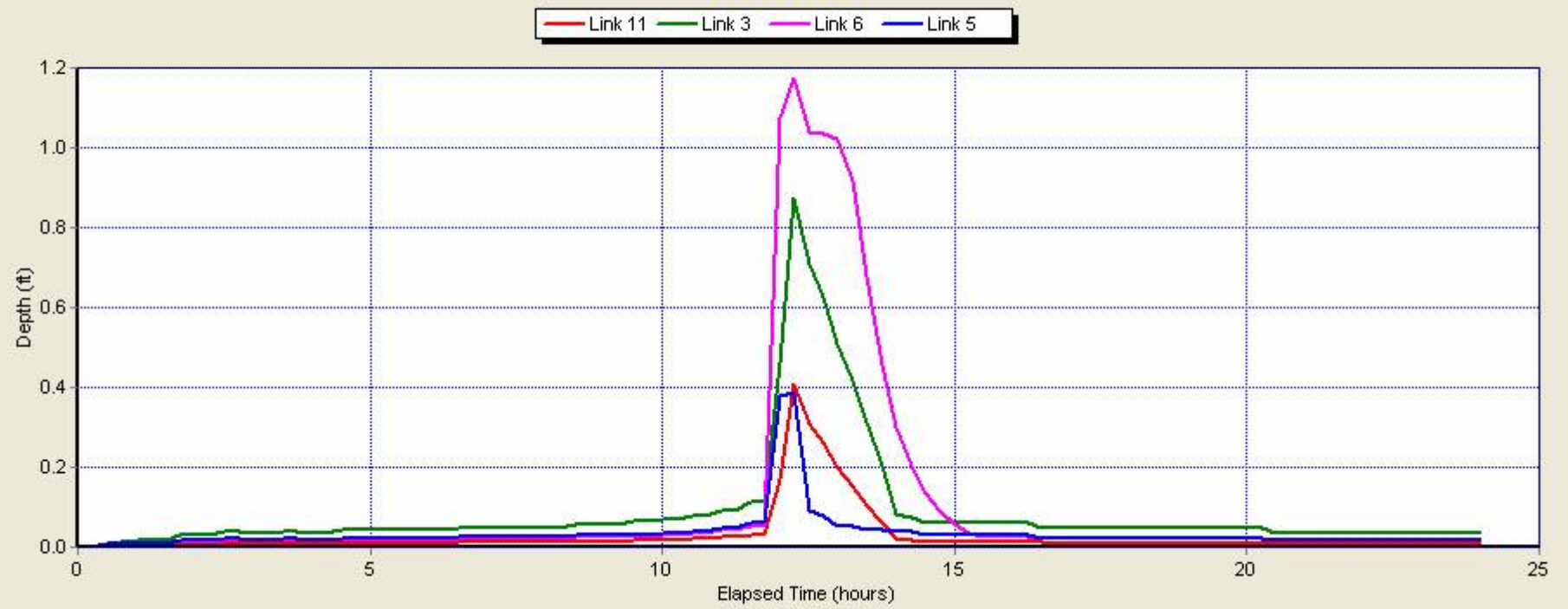
Link 11 –downstream western most swale

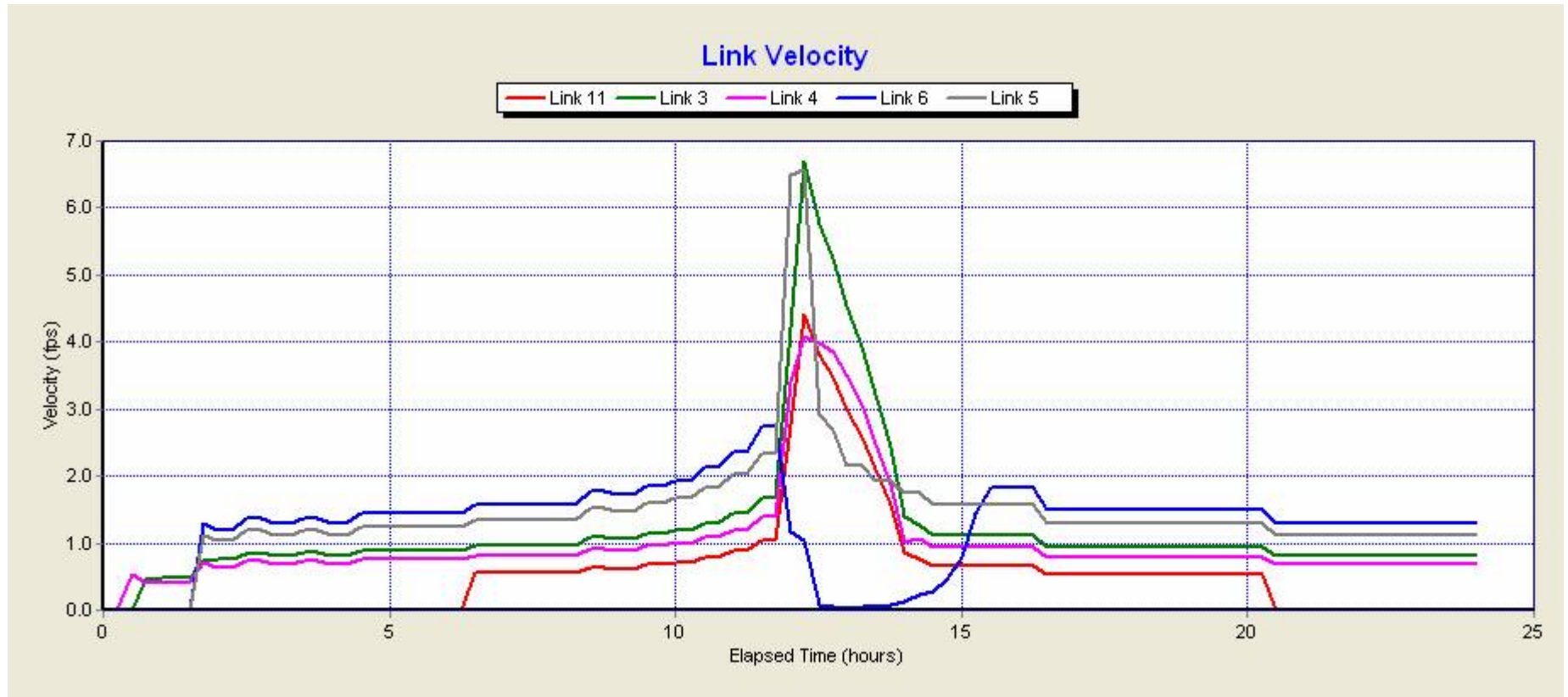
Link 3 - upstream western most swale

Link 6 - downstream swale to the east

Link 5 – upstream swale to the east

Link Depth

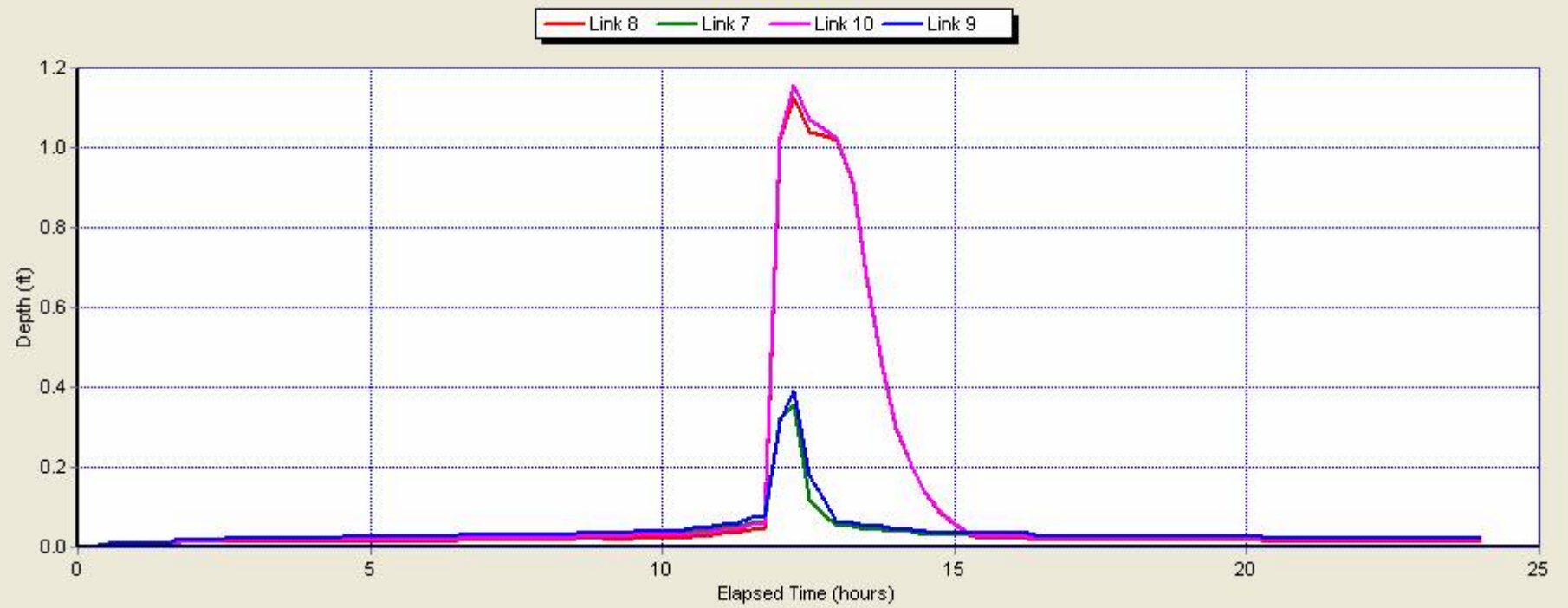


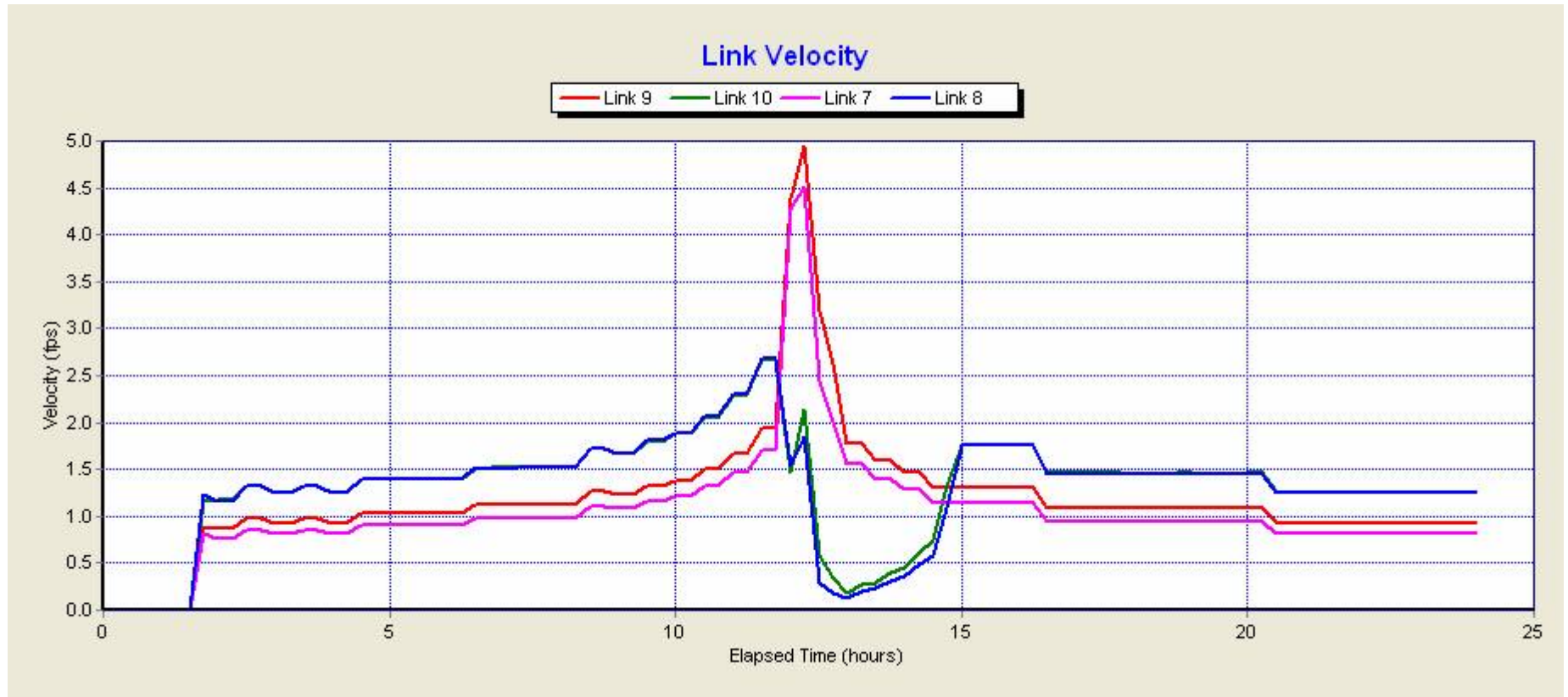


The 2 swales to the east:

Links 8 & 10 are downstream, 7 & 9 are upstream

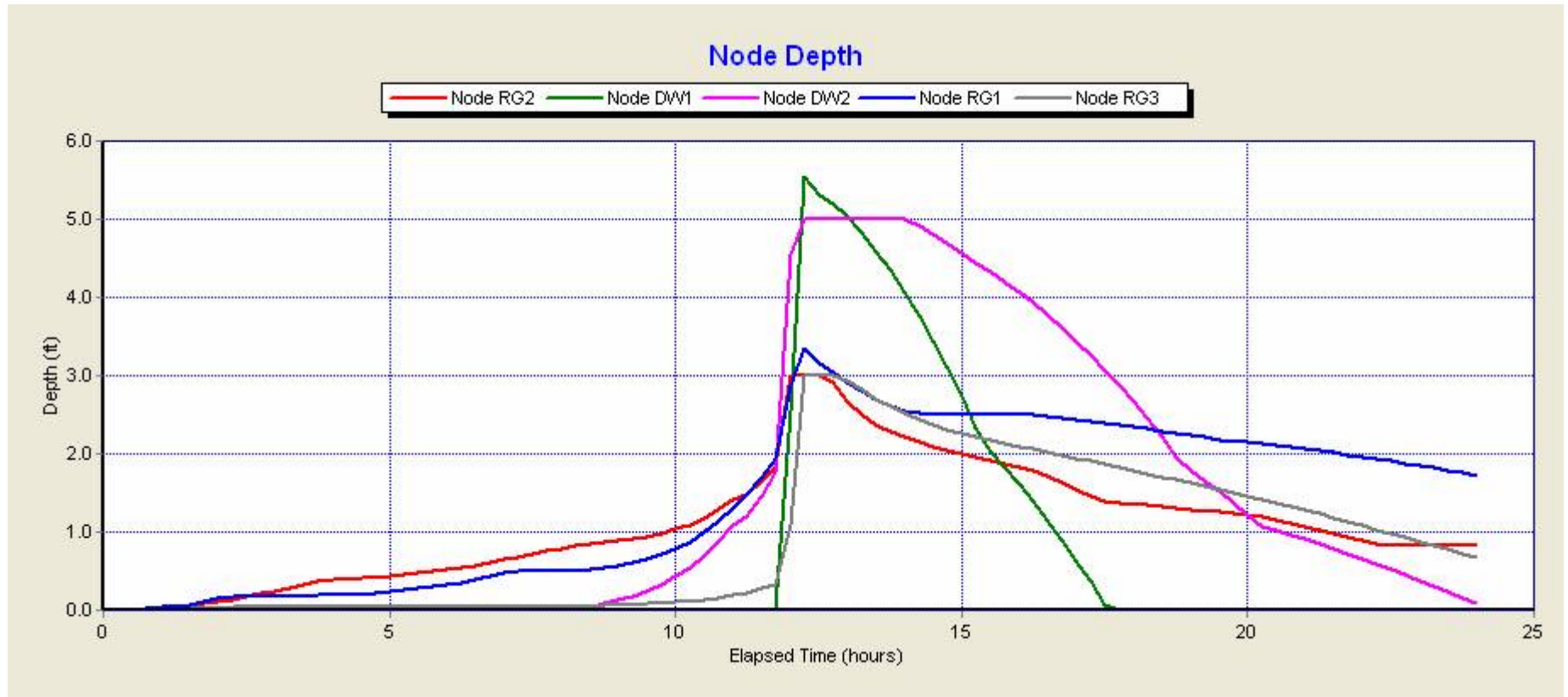
Link Depth





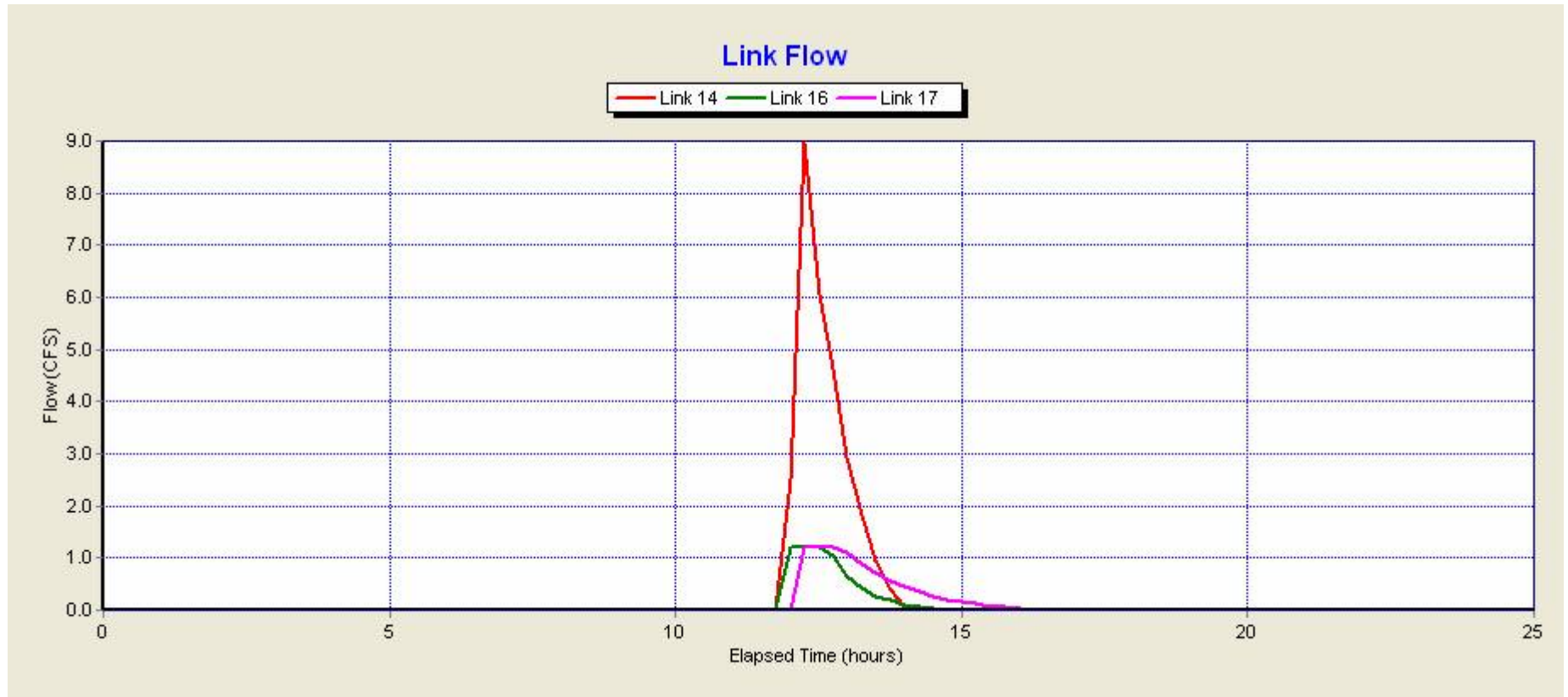
The big differences in depths and velocities are caused by the rain gardens downstream filling up and backing water up (but only a little ways up).

Now dry well (DW) and rain garden (RG) depths:



It's conceivable that the dry wells get a lot of water. The connections from the DW to the swale are made via ditches. DW1 overflows into the ditch and down below the ditch overflows into the dry well area.

Lastly rain garden outlet flows:



Link 14 –RG1 outlet
Link 16 – RG2 outlet
Link 17 – RG3 outlet

There will be a little overflow in RGs 2 and 3, well within what is acceptable. Rain garden 1 overflows, even with the dry wells. The model may be over-predicting flows and it could be adjusted downward a bit. The overflow for Rain garden 1 was set 1ft below the top.

The model did not account for any infiltration through the swales. Installing check dams or stone drops along the French Drain path can store additional water during low flow increase infiltration through the bottom (maybe). Typically eroded watershed soils washed onto decent draining

areas will pinch off infiltration capacity pretty quickly. Additional storage in the drywell - rain garden 1 system would be helpful. If swales were planted with some deep rooted natives, then the swales should probably be a little bigger to account for increased friction.

Comments on the model results and preliminary design drafts (submitted by JFNew Water Resource Engineer, summarized for report purposes)

Rain garden 3 sizing is fine at about 5,000 sf of area with sandy loam soils. With a 10-year rain event there wouldn't be any overflow.

On Rain garden 2 (RG2) and its forebay, in the model they were about 500 sf each. Two different options were investigated: the tile drain (or underdrain) into RG2 was brought directly into RG2 or directly into its forebay. Either way, with a 9" pipe there was a velocity of roughly 9 fps, very fast. Wherever the tile drain comes out it will need energy dissipation (basically a stone outlet). It was also modeled by bringing the tile drain into the RG2 forebay first. When this is done, the pipe under the road from the forebay to RG2 should be 12", otherwise, if the underdrain is brought directly into RG2 the pipe between the forebay and RG only needs to be 9". Though the idea of using a smaller pipe is appealing, it is a better idea to send the inflows to this combo and use as much area as possible to infiltrate. The rain garden basins were assumed to be about 3-ft deep max. The pipe from the forebay was set about 1-ft above the bottom of the basin and the overflow for the rain garden was set 1.5ft above the bottom of that basin. The overflow standpipe on RG2 was assumed to be 2ft in diameter. If the pipe out of that basin is at or above a 1% slope then it can be 9-12" in diameter and it should be fine.

For your French drain along the west side of the road starting near the cattle barn, tie as many downspouts into it as you possible so that no concentrated flows run off the surface. Previous designs have used an underdrain with a foot of a topsoil/sand mix (at least 50% sand mixed with a very low clay content topsoil) and two feet of sand and then used anywhere from a 6-inch to a 12-inch perforated plastic pipe (ADS N-12). Previous designs have typically spec'd a 3-inch annulus of gravel around the pipe with the gravel wrapped in a geotextile filter fabric. In the model 9" and 12" drain tiles were simulated. The smaller pipe can handle the flows, but the velocities are higher. In the model It was conservatively assumed no infiltration into underlying soils. There might be some, but with those high slopes and a good rain, infiltration within the swales will decrease. If pea gravel is used above your underdrain, it's recommended to wrap the pipe in a geotextile filter fabric. The soil/sand mix would be more prone to clogging. The area up near the cattle barn is a tough area. It's going to receive so much foot traffic. The ideal would be to put some kind of drain there that would be cleaned out every once in awhile. The underdrain could start right at the downspout in front of the storage area and maybe put some kind of sacrificial dry well.

The location for a purposed dry-well south of the goat barn is not ideal and not needed. A swale between the goat barn and the Van Auken barn should not be constructed. The downspouts on the goat barn should be brought to a dry well. It was modeled as 10ft x 10ft area, 6-ft deep and that worked fine. It only got water 5-ft deep in the 10-yr event and the outlet from it was set at 4-ft. Bring as many downspouts as possible into the tile drain.

The most problematic area is the area at the base of the hill in the location of Rain garden 1. That area has the highest potential flows – 14 cfs, with velocities as high as 9 fps. Let the drain from the catch basin on top of the hill go to the lake directly or bring it into a whole bunch of stone. In big events water will fly through there. Outlet water from that tile to remove the energy and sediment out of that water before it goes over to RG1+. Even with the sediment basin at 1000 sf and 4ft deep and the rain garden at 1500 sf at 3ft deep, and 1-ft diameter pipe between them (and set 3ft above the bottom of the sediment basin) the sediment basin still floods. Consider foregoing RG1 altogether and let the pipe on the hill just go right to the lake and put some kind of rain garden or dry well near the northwest corner of the pole barn and tie in your tile drain into that and then over to RG1.

Appendix D:
Landowner Agreements



Wise Growth Through Stewardship

708 Roosevelt Road
Walkerton, Indiana 46574
Phone: 574-586-3400 ext. 341
Fax: 574-586-3446

Sara Peel
Aquatic Ecologist
email: speel@jfnew.com

Corporate Office:
Walkerton, Indiana

Crete, Illinois

Indianapolis, Indiana

Grand Haven, Michigan

Cincinnati, Ohio

Native Plant Nursery:
Walkerton, Indiana

www.jfnew.com

11 August 2004

Steuben County Commissioners
317 S. Wayne Street
Angola, Indiana 46703

Dear Sirs:

JFNew is working with the Crooked Lake Association (CLA) to complete an engineering feasibility study. The purpose of the project is to address the feasibility of implementing erosion control projects in the Crooked Lake Watershed in order to slow loading of sediment and associated nutrients that can impair water quality in the lake. We conducted a site visit earlier this month to address stormwater runoff from the Steuben County 4-H park to Crooked Lake. Our findings indicate that the installation of several inexpensive measures could slow stormwater runoff from the park and reduce erosion of the gravel roads thereby reducing sediment and sediment-attached nutrient loading to Crooked Lake.

We are proposing the use of a series of deflector logs and gravel-filled drainage channels to direct stormwater runoff off of the roads and into a rain garden. Water bars installed across the gravel roadways would direct water away from the road into a gravel-lined drainage swale. The drainage swale would then carry water away from the road toward the rain garden, a bowl-shaped garden designed to absorb and filter stormwater. A rain garden resembles a typical flower garden planted with perennial, deep-rooted native plants. The garden will provide landscaping and wildlife habitat while filtering stormwater runoff from the west end of the 4-H park. The rain garden will require little maintenance or upkeep, will reduce lawn care cost associated with the current turf grass, and could be used as an educational technique or demonstration project for stormwater filtration.

The enclosed conceptual design figures indicate the locations identified for rain garden creation and the associated water bars and drainage swales. Additionally, representative photos of typical rain gardens and conceptual water bars are also included. If you agree with this concept plan for the stormwater reduction project, then please sign below and return a copy to me in the envelope provided. Signing this supports our efforts to obtain additional grant money for design and construction funding. We welcome any suggested changes you might have at this time, so please feel free to write comments on the draft plan and return them to me. Please call me if you have any immediate concerns or questions. Thank you for your consideration.

Please contact me directly should you have any questions pertaining to this project and its scope at (574) 586-3400 or speel@jfnew.com. We are more than happy to address any concerns you might have. Thank you for helping us assist the Crooked Lake Association in their goals to reduce pollutant loading into the Crooked Lake.

Thank you for your consideration.

Sincerely,

Sara Peel
Project Manager

I agree with the above concept plan.

cc. Keith Hoskins, Crooked Lake Association; JFNew file 03-01-10/01

STEBEN COUNTY DRAINAGE BOARD MEETING – JULY 17, 2006

The Steuben County Drainage Board met on July 17, 2006 at 2:00 P.M. in the Commissioner's Room in the Community Center. Present were Chairman, F. Mayo Sanders; Members Ronald Smith and James Crowl; and Steuben County Surveyor, Larry Gilbert. Present also were: Roberta Osborne, Steve Osborne, Chet Janik, Ken Wisthoff, Randy Chapman, Mark Reinhard, Derek Frederickson, James Hale, Jack Ryan, Sara Peel, Ken Penick, Rodney Renkenberger.

1. Judge Cole Regulated Drain

Jim Hale came before the Board to voice his concern with the amount of water coming from the Mutton property, the golf course on CR 200N and now the proposed residential duplex development of Magnolia Park. All the water from this area comes to SR 827 and only has a 30 inch outlet to go under the road. Mr. Hale stated that the State created all the inlets, but no outlets, when SR 827 was redone. County Surveyor stated that a larger pipe under SR 827 will cause the same water problem for the next CR since there is only a 30 inch pipe there, plus there is nothing downstream that can handle it. Mr. Hale stated that he has talked with Mr. Headley and Mr. Pollard and they are willing to do whatever to help out this situation. County Surveyor reported that there is a balance of \$5,000 in the unit and it only brings in \$5,000 a year. County Surveyor stated that when the City allows new development they need to work closer with the County and help to maintain some of the old County drainage systems because they can't handle the excess. The drain goes back and forth from open ditch to tile and crosses the railroad tracks about five times. This area needs to be looked at closely to come up with a plan for these issues.

2. JF New – Crooked Lake 4 H Park

Sara Peel was in attendance for final approval on the project at Crooked Lake. Ms. Peel stated that the 4-H Board gave their approval with a contingency that one change be made to rain garden #1, which will still allow parking in that area. Funding for this project comes from a \$20,000 Lare Grant, \$50,000 from Great Lakes Commission and \$10,000 from Crooked Lake Association. Motion made by James Crowl to approve the project. Second by Ronald Smith. 3 ayes, motion carried.

3. Oliver Schaeffer Regulated Drain

County Surveyor reported that Steve Colbart has changed contractors from Rick Zimmerman to Ralph Holman to do the tile project, which the Board approved on December 5, 2005. Greg Colbart, located on the east side, is now claiming that he did not approve this project. County Surveyor stated that he informed Mr. Holman that if he puts the tile in, that he will be held liable for the installation. Greg Colbart had planned to attend the meeting but he did not appear.

Appendix E:

Example Bid Documents

Bid Documents and Specifications: Section 1

INVITING BIDS FOR CROOKED LAKE SEDIMENT REDUCTION PROJECT AT STEUBEN COUNTY 4-H PARK, ANGOLA, INDIANA

Pursuant to I.C. 5-3-1 the Crooked Lake Association (Owner), Steuben County, Indiana, will receive bid proposals until 4:00 pm on June 1, **2006** at the location stated below for the construction of the: **“CROOKED LAKE SEDIMENT REDUCTION PROJECT”**.

Bids shall be submitted on the enclosed documents. After a satisfactory bid is received the Crooked Lake Association shall award a contract to the lowest responsible and responsive bidders.

Pursuant to I.C. 36-1-12-4(10), in determining whether a bidder is responsive the Crooked Lake Association may consider the following factors:

- (1) Whether the bidder has submitted a bid or quote that conforms in all material respects to the specifications
- (2) Whether the bidder has submitted a bid that complies specifically with the invitation to bid and the instructions to the bidder.
- (3) Whether the bidder has complied with all applicable statutes, ordinances, resolutions, or rules pertaining to the award of a public contract.

Pursuant to I.C. 36-1-12-4(11), in determining whether a bidder is a responsible bidder, the Crooked Lake Association may consider the following factors:

- (1) The ability and capacity of the bidder to perform the work.
- (2) The integrity, character, and reputation of the bidder.
- (3) The competency and experience of the bidder.

Bids shall be submitted to:

**JFNew
Mark Prankus
708 Roosevelt Rd
Walkerton, IN 46574**

Bid Documents and Specifications: Section 2

INSTRUCTIONS TO BIDDERS

TITLE AND LOCATION OF THE WORK: The work on this contract is identified as: **Crooked Lake Sediment Redcution Project**, located on the south side of Crooked Lake within the Steuben County 4-H Park grounds near Angola, Indiana.

SPECIFICATIONS: Specifications to be used in the construction of this project are contained herein.

PROPOSALS: Bid proposals shall be submitted on the forms provided herein.

INTERPRETATION OF THE PLANS AND SPECIFICATIONS: If any person contemplating submitting a bid for this work is in doubt as to the true meaning of any part of the Plans, Specifications or other proposed contract documents, he or she may submit a written request to the Owner for interpretation thereof. The Owner will not be responsible for any other explanations or interpretations of the contract documents.

ADDENDA: Any addenda issued during the time of bidding, or forming a part of the contract documents given to the bidder for preparation of his or her proposal, shall be covered in the proposal and shall be made a part of the proposal. Receipt of each addendum shall be acknowledged and attached to the proposal.

AWARD OF THE CONTRACT: After a satisfactory bid is received the Crooked Lake Association shall award a contract to the lowest responsible and responsive bidders on or before June 15, 2006.

Bid Documents and Specifications: Section 3

BIDDERS LUMP SUM PROPOSAL

Angola, Indiana

Instructions to Bidders:

All Bidders shall utilize this form. Except as otherwise specifically provided, all parts shall be fully and accurately filled in and completed.

Project: **CROOKED LAKE SEDIMENT REDUCTION PROJECT**

Date: _____

To: Mark Prancus
JFNew
Crooked Lake Sediment Reduction Project
708 Roosevelt Rd
Walkteron, IN 46574

PART 1 BIDDER INFORMATION (Print or Type)

0.0 Bidder Name: _____

0.0 Bidders Address: _____

City: _____ State: _____ Zip: _____

Phone: (_____) _____ Fax: _____

0.0 Bidder is a/an *[mark one]*:

_____ Individual _____ Partnership _____ Indiana Corporation
_____ Foreign (Out of State) Corporation
_____ Joint Venture _____ Other: _____

1.4 Bidders Federal ID No. _____

PART 2
PROPOSAL (BID)

- 2.1 The undersigned Bidder proposes to furnish all necessary labor, equipment, tools, apparatus, materials, equipment, service and other necessary supplies, and to perform and fulfill all obligations incident thereto in strict accordance with and within the time(s) provided by the terms and conditions of the Contract Documents, including any and all addenda thereto, to construction four (4) raingardens, one (1) dry well, one (1) catch basin, and approximately 750 feet of French Drain. Two hundred feet (200') of existing roadway will be paved along with installing a curb. Clean-up and mobilization/demobilization fees will be included. All work outlined in the plan set will be completed for the total sum of: _____ Dollars (\$ _____).

Signed the _____ day of _____, 2006

Bidder/Contractor - Signature

Name - Printed

PART 3
BID SCOPE OF SERVICES

Bidder shall excavate and install four raingardens in the locations and to the depths described in the Crooked Lake Sediment Reduction Plan set. Raingardens will be planted with the native species as called for in the plan set. Bid price shall include mobilization, demobilization, installation, materials and clean-up of raingardens and any areas disturbed during construction.

Bidder shall install ~750 feet of French Drain as described in the Crooked Lake Sediment Reduction Plan set. Bidder shall also install a berm in the designated area, excavate and install a dry-well and a sediment basin in the appropriate areas. Bidder shall also pave approximately 200' of existing roadway in the designated area. Bidder shall regularly provide written or verbal communication to the Crooked Lake Association and/or their agent, JFNew, on the progress of the project.

PART 4
CONTRACT DOCUMENTS AND ADDENDA

- 3.0 The bidder agrees to be bound by the terms and provisions of all Contract Documents and incorporates such Contract Documents herein by reference.
- 3.0 The Bidder acknowledges receipt of the following addenda:

Addendum Number

Date

Bid Documents and Specifications: Section 4

CONTRACT

THIS AGREEMENT, made and entered into by and between the Crooked Lake Association, as party of the first part, hereinafter called the "Owner and _____, as party of the second party, hereinafter called the "Contractor"

WITNESSTH

That for and in consideration of the mutual covenants herewith enumerated, the Owner does hereby hire and employ the Contractor to furnish all materials, equipment and labor necessary to fully construct the work designated as follows:

**CROOKED LAKE SEDIMENT REDUCTION PROJECT
AT STEUBEN COUNTY 4-H PARK, ANGOLA, INDIANA**

According to the plans, standard specifications, supplemental specifications, profiles and drawings therefrom, and any supplemental or special provisions set out or referred to in the Contractor's attached Proposal, and hereby agrees to pay the Contractor therefor, for the actual amount of work done and materials in place, as measured and approved by the Engineer or duly authorized representative, for the lump sum price as stated in the Contractor's attached Lump Sum Bid Proposal dated _____, which sum the Contractor agrees to accept as full payment for such construction work; and

IT IS FUTHER MUTALLY AGREED:

That the accompanying Proposal together with the plans, standard and supplemental specifications and special provisions herein designated and referred to, are hereby made a part of the Contract the same as if herein fully set forth; and

That the Contract amount may be paid to the Contractor upon progress estimates of completed and approved work prepared by the Engineer, in an amount not exceed Eighty Five Percent (85%) of such estimates, Fifteen Percent (15%) shall be withheld by the Crooked Lake Association for a period sixty (60) days after the completion of the work, for the purpose of securing payment of all properly prepared and certified statements of indebtedness which shall have been filed against the Contractor for labor performed and materials furnished or other services rendered in carrying forward, performing and the completing of this contract, and such estimates shall also be subject to the provisions of the Standard Specifications on file in the office of the Owner and made a part hereof; and that before any estimate is paid to the Contractor, he shall furnish receipts for all debts incurred in the prosecution of such work or satisfactory evidence and assurance that the same have been paid; or shall consent to the withholding by Owner from his final estimate of sums sufficient to cover such indebtedness, which sums may be held until such indebtedness is settled, or until conclusion of any litigation in

the relation thereto filed within such period; and that no monies due on this final estimate shall be paid until the work is fully completed and accepted as provided in the Specifications.

CONTRACT 1 OF 2

IN TESTIMONY WHEREOF, the Bidder has hereunto set his hand this _____ day of _____, 2006.

Contractor

By

IN TESTIMONY WHEREOF, the Crooked Lake Association does hereby accept the foregoing agreement and has herewith set their hands this day _____ of _____, 2006.

Crooked Lake Association
Angola, Indiana

Keith Hoskins, President